

JOINT WIPING
AND
LEAD WORK



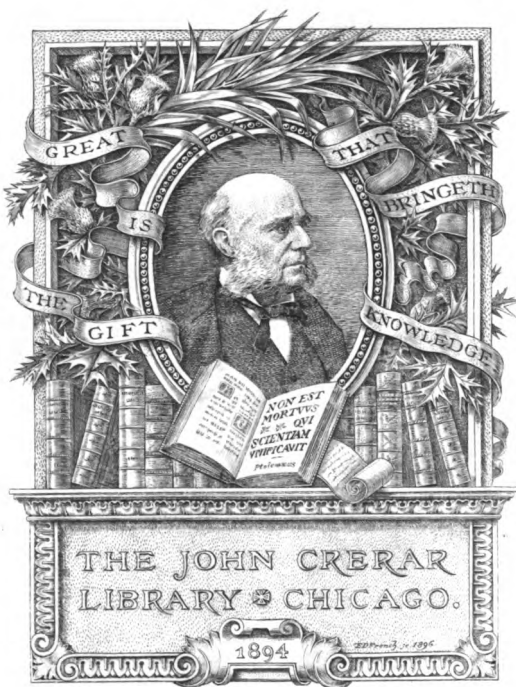
WILLIAM HUTTON

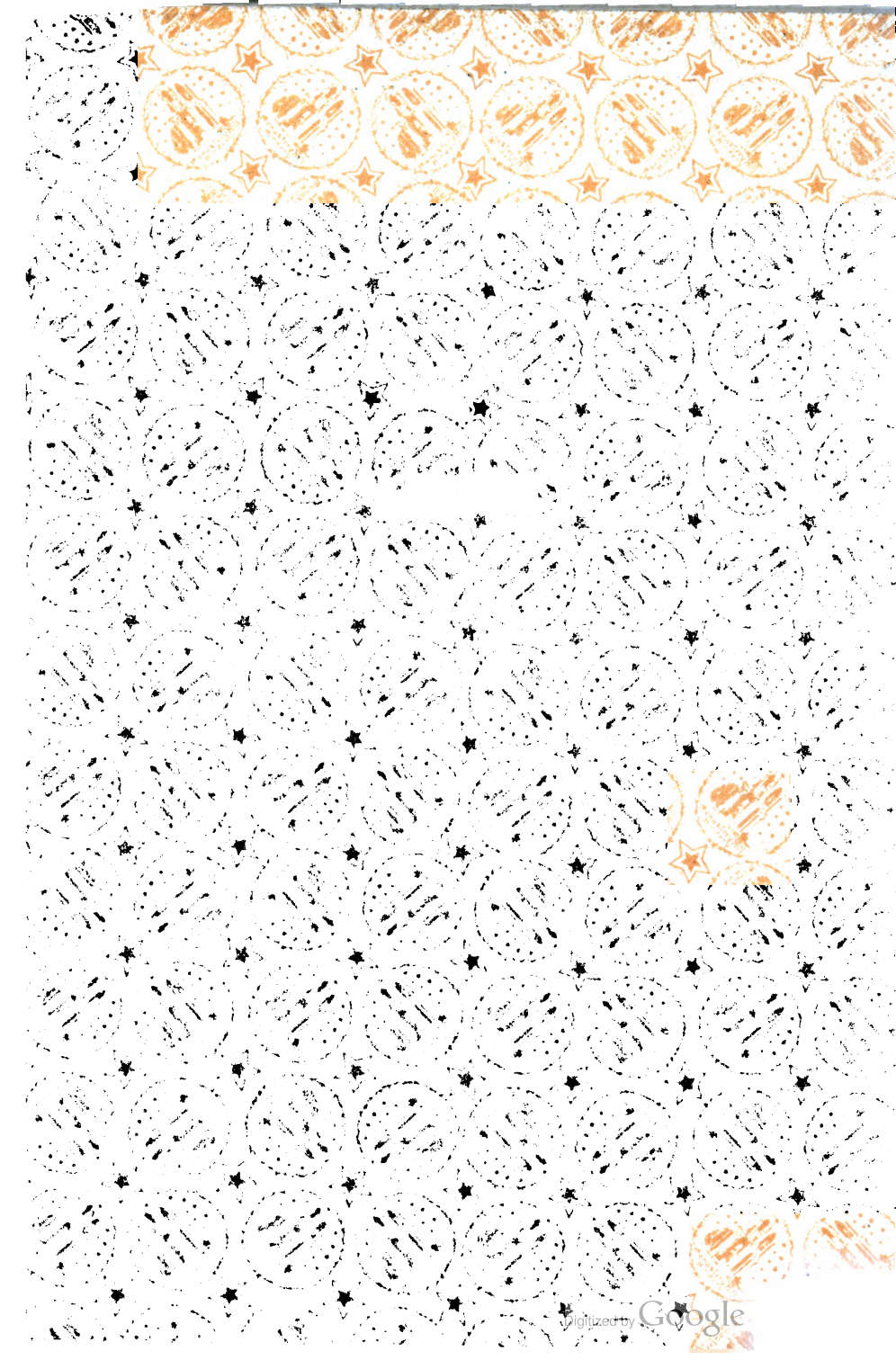
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THE
JOINT WIPING
AND
LEAD WORK

A Modern Treatise on the Preparation
of Lead Pipe and Connections, and the
Wiping of Joints in Various Positions

BY
WILLIAM HUTTON

REPRINTED FROM
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TABLE OF CONTENTS

	PAGE
INTRODUCTORY	3
CHAPTER	
I. SOLDER FOR JOINT WIPING.....	5
The successful joint wiper—How to judge solder—Component parts of wiping solder—Deterioration of solder—Appearance with various impurities—Doctoring solder—Melting point of solder—Cleaning solder by granulation—Deterioration by burning and its cure—Care of solder—Table of melting points.	
II. TOOLS REQUIRED IN JOINT WIPING.....	10
Advantage of keeping tools in good condition—Tools actually necessary and others that may be used with advantage—Use of each tool for a particular purpose—Advantages in different shapes of tools—Wire cloth for removing grease—Hints on the care of bending springs—Roughing jaws of expanding pliers—Care of cloths.	
III. DATA ON LENGTH OF JOINTS, SOLDER REQUIRED, WIPING CLOTHS, ETC.....	13
Hints on acquiring proficiency—Length of joints—Comparison of English and American practice—Reason of breakage of joints at end of cleaning—Size and thickness of cloths—Disadvantage of using too thin cloths—Table of lengths of wiped joints and size of cloths—Table of weight of solder required for various sizes—Amount of solder required in pot—Economising in the use of solder—Right heat and how to judge it.	
IV. PREPARATION OF JOINTS FOR WIPING.....	18
Importance of careful work—Value of correct preparation in securing tight joints—Value of annular space at junction—Difficulty in wiping joints of incorrect proportions—Neat appearance of work with joints of uniform length—Preparation of round joints—Composition of plumber's soil—Fixing the parts, with clamps, with strings and with nails—Importance of securing rigid fixing.	
V. ONE-HAND AND TWO-HAND METHODS OF JOINT WIPING	24
Tinning joints before wiping—Wiping round joints by two-hand method—Various steps in getting correct heat, wiping and finishing—Advantages of the two-hand system—Wiping joints with the use of one hand—Forming, wiping and finishing the joint—Claims made in favor of this method.	
VI. WIPING JOINTS BY ROLLING METHOD, AND TINNING BRASS WORK.....	30
Method of securing exceptionally good shape—Fixing parts for wiping by rolling method—Burning parts together—Fixing by means of wooden splints—Securing the parts on the blocks—	

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TABLE OF CONTENTS

CHAPTER	PAGE
Forming and wiping the joint—How to file brass ferrules—Tinning with copper bit—Tinning end and inside to retard corrosion—Preventing solder sweating through.	
VII. PREPARING BRANCH JOINTS FOR WIPING.....	34
Effect of bad fitting of branch—Stoppage of water way by spigot end—Weakening of pipes by tool marks—Use of tap borer, expanding pliers and bending pin—Removal of burs—Making a gauge to mark cleanings uniformly.	
VIII. WIPING VERTICAL AND HORIZONTAL BRANCH JOINTS	39
Setting up the joint—Forming and wiping vertical branch joint—Method of steadying joint to prevent sagging—Use of splash stick in getting up heat—Wiping with narrow cloth—Fixing branch joint in horizontal position—Pouring on, forming and wiping horizontal branch joint—Wiping a joint with main pipe in vertical and branch in horizontal position.	
IX. WIPING VERTICAL ROUND JOINTS, FLOOR AND WALL FLANGES.....	45
Difficulties in wiping vertical joints—Fixing vertical joints for wiping—Pouring the solder by various methods—Forming and wiping the joint—Cardboard solder catcher—Preparing and wiping a floor flange—Removal of excess solder—Preparing and wiping wall flange—Protecting the wall.	
X. WIPING JOINTS ON LARGE PIPE.....	55
Large joints as a test of skill—Preparation of large joints—Removal of dents from pipe—Easy method of filing ferrule—Fitting lead pipe to ferrule—Forming and wiping the joint—Removal of solder—Wiping large joints in horizontal position—Careful fitting required—Trouble in maintaining heat.	
XI. WIPING Y-BRANCH AND OVERCAST JOINTS.....	63
Benefit of providing easy flow in branch—Result of back wash in waste pipes—Preparation and wiping of Y-branch—Making well-fitting junction—Bending the branch pipe to suit Y—Protecting other joints when wiping—Joints of various types—Overcast joints—Reason for overcasting—Overcast wiped joints for pump work—Joints made with copper bit—Method known as cold wiping—Its use and application—Closing ends of lead pipe.	
XII. WIPING JOINTS ON VARIOUS KINDS OF PIPE.....	71
Types of joints required on various kinds of pipe—Length as a factor of safety—Tinning pipe to prevent corrosion—Lapping the ends of copper pipe—Getting up heat on copper pipe—Cooling the joint—Wiping joint on iron pipe—Joints on tin-lined pipe—Bismuth solder—Joints on tin pipe—Soldering ammonia pipes—Supporting pipes to prevent sagging and breakage—Breakage due to expansion.	

INTRODUCTORY

IN preparing the material for this book the author has had in mind the needs of the young and inexperienced plumber for a guide in acquiring proficiency in the art of preparing pipe of lead and other metals and wiping joints of various types. It is not expected that the book will teach those to become expert in this branch of the plumbing profession who are without opportunities of putting the hints it contains into long continued practice. It will, however, take the place of the little handbook, "Practical Hints on Joint Wiping," which was reprinted from the pages of *Metal Worker, Plumber and Steam Fitter*, and which has proved of great assistance to beginners, as is evidenced by the fact that the last copy of its sixteen editions has been disposed of. The appearance of the matter comprising this book in the reading pages of *Metal Worker, Plumber and Steam Fitter* brought forth so many favorable comments that the publisher decided to make it available in book form.

It has been endeavored in preparing the book to offer the different examples of preparation and wiping of joints in such manner that the essential motions of the hands and tools will stand out clearly, and the illustrations accordingly have been prepared from actual photographs of the operations with this always in view. They have also been made so that each motion of the hand and tool is shown in the consecutive order of actual practice and the whole forms what might be termed a motion picture story of the plumber's art. The student will do well to study carefully the illustrations,

noting especially the position of the fingers in the wiping operations and following them as closely as he can in practising what the text sets forth. Above all, constant practice is advocated.

Nothing is acquired without laborious application, and skill in lead working is no exception. The dexterity and knowledge of the metals and tools handled which was necessary to prepare this text were acquired through years of close observation and study. It is well within the ability of the majority of young plumbers to attain really first-class rank as mechanics, but there is only one path to that position, and that is the one just indicated. If this book makes that path easier, it will have accomplished the intention of the author and the publisher.

APRIL 5, 1912.

Joint Wiping and Lead Work

CHAPTER I

SOLDER FOR JOINT WIPING

EVER since the first wiped joint was made, the ability to perform the operation with speed and certainty, the possession of the skill and knowledge of metals necessary to make the joint permanent and well appearing, has been the goal which all young plumbers have striven to reach. The making of a wiped joint is looked upon the world over as the supreme test of craftsmanship. No matter if its importance is overrated, the necessity of this accomplishment to anyone claiming first-class ability is apparent. Like the frontiersman with his gun, "He may not want it often, but when he does he wants it bad."

But the art can never be wholly acquired or communicated through the medium of books. All that can be hoped for from a book is that it will make clear the various steps in the process and that which has been found to be helpful to those who have learned it by long experience and practice will teach the beginner what to avoid and what to perform. Only close observance and careful study will lead to proficiency and only then when these have been combined with practice.

Temperament seems also to have much to do with the making of a successful joint wiper, and it is rare that a

nervous or excitable individual reaches proficiency. There are exceptions to every rule and there doubtless are to this, but one essential certainty is the ability to keep the nerves in control and to make haste slowly.

THE FIRST REQUISITES

The student should first of all learn how to judge solder. He should learn to determine when the right proportions of tin and lead are present, when it contains substances other than these, or when it has been reduced in quality by overheating. This skill is best developed by observing expert workmen when they are using solder known to be of good quality and of correct proportions. The plumber does not generally possess the scientific knowledge nor does he have the facilities to test his solder otherwise than by appearance, but experience tells him that this is always a reliable index as to its quality.

COMPONENT PARTS OF WIPING SOLDER

The proportions of tin and lead in wiping solder of good quality are usually two of lead to one of tin. Some mechanics prefer to have it finer—that is, to have a larger proportion of tin, but the proportions first named form the standard. In process of using, by constant heating and reheating, a proportion of the tin is lost and the metal becomes “coarse”; the particles do not lie in so close relation to each other and the solder is porous and liable to allow water under high pressure to percolate through its substance. It is then necessary to add a little tin to make up this loss. The tin may also be lost by failure to stir up the contents of the pot occasionally, as the two metals are not of the same specific gravity and the tin tends to come to the top and is removed in excess of its proper proportion. Accidental overheating will also affect it by

"burning out" the tin, as its melting point is lower than that of lead and it therefore oxidizes more easily.

HOW TO JUDGE SOLDER

The appearance of the solder when cold is what plumbers judge the quality by. A small quantity is poured out on a level stone or brick and the color on setting is noted, also the number and size of bright spots on its surface. On a piece about the size of a silver dollar will appear, if the correct proportions are present, about four spots $\frac{1}{8}$ in. or so in diameter. The side of the solder which was in contact with the stone will be bright. Adding lead to the solder will reduce the size or number of bright spots, and if continued will turn out solder of chalky appearance and coarse texture. Adding tin will brighten it.

The solder should be well stirred before a test is made or an incorrect impression of its quality will be received. The rate of cooling also affects its appearance. If cooled too quickly, as would happen when the solder is poured on an iron plate, the metal will appear much finer than it really is. If the appearance is chalky with numerous minute bright spots, there is probably a small percentage of zinc or antimony in it. Filings from brass ferrules or dirt picked up along with the surplus solder when a joint is being wiped will often spoil a good potful and the greatest care should be taken to keep these out.

DOCTORING SOLDER

You may have spoiled your solder also by overheating it or you may have been tinning your brass couplings by dipping them. This should never be done owing to the risk of overheating the brass and releasing a proportion of the zinc. It may also have happened by pouring the solder when at too high a temperature over a brass ferrule in the process of wiping a joint. Now for the cure.

Your solder should be made extra hot, almost twice the temperature it should be if all were right. Plumbers' solder melts at 440 deg. F. To clean it we want to raise it to 800 deg. F. Why? Because zinc melts at 773 deg. F. and we want to bring it to the surface and then skim it off. Do not make it red hot in the daylight or you will have reached a temperature of about 1,100 deg. F. and you will spoil it. Throw in a lump of sulphur (rosin also helps) and this mixing with the zinc helps it to float. Stir up the contents and skim off the top, which will be a mixture of lead oxide, putty powder, sulphur and zinc. Then when it has cooled down to about the working point stir in tallow and some more rosin and skim again. Then add a little tin to replace what was burned out in raising the metal to such a high temperature, and it should be ready to wipe with again.

Another way to obtain the same result is to granulate the solder by pounding it. When it reaches the cooling point it will break up as fine as sawdust. Then put it into a dish and cover it with muriatic acid and allow it to stand over night. This will remove all traces of zinc.

If solder becomes overheated through inattention do not stir it until it has cooled to about the correct wiping temperature; otherwise more tin will oxidize on the surface and be lost. If you consider that tin forms putty powder at 428 deg. F. and lead oxidizes at 612 deg. F., the two together at 440 deg. F., you will understand what happens when you allow it to become red hot in the daylight, for it is then about 700 deg. hotter than it should be. Do not add fine or strap solder to your pot unless you are certain of its purity.

Solder may be adulterated with antimony or bismuth to secure brightness and it will then be exceedingly difficult to wipe a joint that will not drop at the bottom. Be careful,

always to put paper below a joint to catch your surplus solder, never allow brass or zinc to mix with it and never melt zinc in a pot that is to be used again for solder. Make a note of the accompanying table.

TABLE OF MELTING POINT OF SOLDER AND ITS COMPONENT PARTS

Degrees F.

Plumbers' solder, 2 parts of lead, 1 part of tin, melts at.....	440
Fine solder, 1 part of lead, 1 part of tin, melts at.....	370
Tin melts at.....	422
Lead melts at.....	618
Zinc melts at.....	778

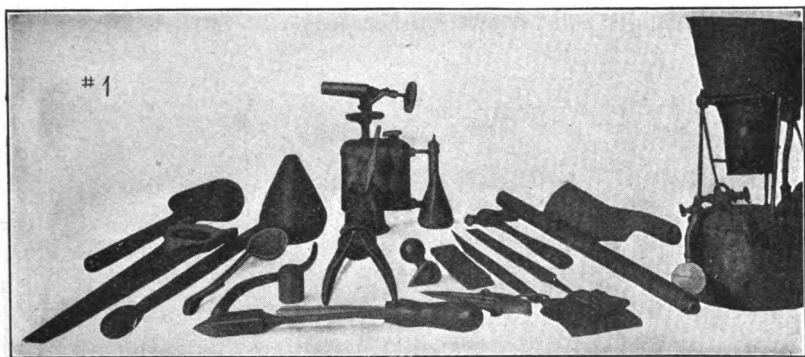
CHAPTER II

TOOLS REQUIRED

IT HAS often been said that a good workman may be known by his tools and there is a good deal of truth in the saying, for nearly every expert mechanic has a special pride in his kit and will go to some trouble to keep it in first-class condition. The man who can produce good work with poor tools will certainly do it better and easier with good ones, and if efficiency is desired it is important that the tools should be maintained in perfect order. Those actually required to execute lead work and joint wiping are shown in the accompanying illustration, Fig. 1. Several others can be advantageously used and should form part of the kit for use as occasion may arise. Among those may be mentioned, dressers, shavehooks and bending pins of special shapes for beating up short bends and preparing the parts for wiping joints in difficult positions. Tap borers, joint clamps, gauges and other aids to good work which are mentioned elsewhere are also good investments.

In Fig. 1 will be seen on the left a wooden mallet of a pear shape. This is used for beating over the end of a pipe on the floor or wall when a flange joint is being made ready, and also for widening the ends of large pipes to fit a ferrule and for other purposes for which the plumber will find it convenient to use. Next to it is a saw with teeth on both sides. One side may be "set" for use in cutting boards if desired. Then there is the "dummy," a very useful tool for removing dents in 4-in. lead pipe or for bending a piece of pipe to special shapes. Behind it is a turn-pin of large size used to widen the ends of 3-in. and 4-in. pipe. The soil cup and a smaller sized turn pin, the solder ladle and a small soldering iron will also be noted.

Beside the ladle is a bending pin, used as a lever to straighten or bend water pipe and to raise the edges of the pipe when a branch joint is being prepared. The drift plug used to drive through lead waste pipe to bring it to the proper shape when it has become dented or flattened lies between the bending pin and the expanding pliers, a very useful tool which takes the place of the turn-pin and makes possible the widening of the end of a pipe without distorting it many times when a turn pin could not be used satisfactorily. The shavehook, dividers and wiping cloths of



Tools required for joint wiping and lead working.

various sizes are also included among the tools that are absolutely necessary. The shavehook shown has one round side, this shape being very convenient for marking off a joint as well as shaving a hollow part. Next to it is a piece of wire "card cloth," a material used in woolen factories in one of the manufacturing operations, but which is very satisfactory as a means of removing grease from lead pipes before commencing to soil the ends. Sandpaper may be used in place of this when it is not procurable.

A half round rasp of moderate coarseness, a 10-in. file and a small hammer are also part of the "necessary kit." Then a set of bending springs are always included and a

good hardwood dresser, the face of which is kept smooth and the edges not too sharp. A solder pot to contain about 10 lb. of solder and a pothook are also included. The shave-hook should be kept well ground up, as should also be the points of the dividers, and it is a good plan to roughen the jaws of the expanding pliers from time to time as the "knurling" soon wears off. Springs should never be overheated to avoid "kinking" them, and the cloths should be kept well greased and a sprinkling of powdered chalk applied to them from time to time. The torch is a convenient tool for warming up ferrules, heating pipes for bending, melting off old joints and for many other purposes.

CHAPTER III

DATA ON LENGTH OF JOINTS, SOLDER REQUIRED, WIPING CLOTHS, ETC.

IT is difficult to lay down empirical rules for the guidance of beginners in joint wiping, as most men have little tricks and mannerisms peculiar to themselves. In fact, all that can be attempted is along the line of suggestion or demonstration of certain consecutive movements of hands, ladle, and cloth made in wiping the particular style of joint desired. Experience and constant practice alone will teach a man when his heat is right, when to stop pouring and begin forming, when the forming has been sufficiently accomplished to insure a smooth and symmetrical surface with the minimum amount of final wiping. The study of the illustrations of this subject will at least show him the position of fingers, etc., at the different stages of the operation, and if he closely follows the hints he will get shape at least while practice will bring him finish.

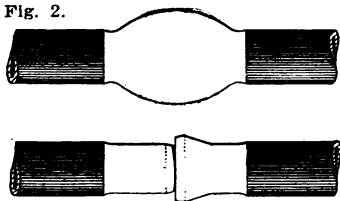
About the first thing the beginner asks is: "What is the correct length to wipe a round joint?" This is entirely a matter of local conditions, custom and taste. Certainly a minimum length might be stated, setting the limit to which the joint may be reduced to give permanence, but a joint so short that it would be insufficient to stand the strains of fitting, turning of unions or movements of expansion would be exceedingly hard to wipe. The weight of the joint is of much greater importance than the length. For instance, English plumbers, as a rule, wipe a much longer joint than is customary in this country, but the joint is not heavier. That is, the body of solder covering the actual junction of the two pipes is not deeper in section than those wiped by

the majority of American plumbers, and therefore not any more serviceable as a means of joining two pipes securely. It is claimed by some that breakages at the end of the cleaning are less likely to occur with a long, slender joint than with a short, "chunky" one, for the reason that movement of the parts is not so suddenly arrested.

The long, gradual taper of the joint probably serves better in taking up part of the strain and the contention may be technically correct, although there are no figures available to prove it so. A table of lengths is therefore given herein for the beginner's guidance, which will insure ample strength and durability in the joint and an appearance which is pleasing to the majority of plumbers. The lengths given are those used by great numbers of expert mechanics.

The size of the small auxiliary cloth used in the forming of joints wiped with the two-hand system is of little consequence; an ordinary flange cloth $1\frac{1}{2}$ in. x $2\frac{1}{2}$ in. will

Fig. 2.



Joint showing weakness from too deep shaving and wiping with thin cloth.

serve excellently. The thickness of the wiping cloth determines to some extent the weight of the joint, and where a thin cloth is used the weight will probably be greater owing to its flexibility. The long, slender joints made by the English plumber are formed by using a very thick cloth,

moleskin of 12 to 16 thicknesses being used. The cloth in this case forms the joint itself, as being held by the extreme edges, only it takes a hollow shape when pressed against the plastic solder and a very symmetrical joint is the result.

Many plumbers like to use a thin cloth because, as they say, they like to "feel their edges." But there is always a chance of making with such a cloth a joint resembling that shown in Fig. 2. It will be noted that the weakest part, namely, the edge of the cleaning, is left entirely bare and

the joint might as well have been $\frac{1}{2}$ in. shorter in cleaning. Cloths of the sizes given in the accompanying table and made of herringbone ticking of 16 thicknesses, or good moleskin of 8 thicknesses, will be found flexible enough to form a joint of sufficient weight and yet stiff enough to preserve the correct outlines.

Both ticking and moleskin cloths require "breaking in" before satisfactory service will be rendered. That is, the surface must be treated so that solder will not adhere to it. The best method is to melt some tallow in a pot and soak the cloths in it. Then press out all excess, and rub powdered chalk or talcum on the surface. The ticking cloth will be workable much quicker than one made of moleskin, the latter material having a softer texture. Such a surface is more liable to slight tears and scratches which take hold of the solder.

The weight of solder required to make joints of given lengths and weights is approximately as given in the accompanying table.

TABLE OF LENGTHS OF WIPED JOINTS

Pipe Diam. Inches.	One-hand System.		Two-hand System.	
	Length of Joint, Inches.	Size of Cloth, Inches.	Length of Joint, Inches.	Size of Cloth, Inches.
$\frac{1}{2}$	2	3×3	$2\frac{1}{4}$	3 × 4
$\frac{3}{4}$	2	3×3	$2\frac{3}{8}$	3 × 4
1	2	3×3	$2\frac{3}{8}$	3 × 4
$1\frac{1}{4}$ water	2	3×3	$2\frac{1}{2}$	$3\frac{1}{4}$ × 4
$1\frac{1}{4}$ waste	2	3×3	$2\frac{3}{8}$	3 × 4
$1\frac{1}{2}$ water	2	3×3	$2\frac{1}{2}$	$3\frac{1}{4}$ × 4
$1\frac{1}{2}$ waste	2	3×3	$2\frac{3}{8}$	3 × 4
2 waste	2	3×3	$2\frac{3}{8}$	$3\frac{1}{4}$ × 4
3 waste	2	3×3	$2\frac{1}{2}$	$3\frac{1}{4}$ × 4
4 waste	$1\frac{3}{4}$	3×3 & 6×6	$2\frac{3}{4}$	$3\frac{1}{4}$ × 4 & $3\frac{1}{4}$ × 5
2 vertical	$1\frac{3}{4}$	3×3	2	3 × $2\frac{1}{2}$
3 vertical	$1\frac{3}{4}$	3×3	2	3 × $2\frac{1}{2}$
4 vertical	$1\frac{3}{4}$	3×3	2	3 × $2\frac{1}{2}$

The two-handed joint, being slightly more slender than the one-handed, requires practically the same amount of solder. These weights are of course approximate, but experience has shown that they are near enough for all practical purposes.

TABLE OF WEIGHTS OF SOLDER FOR JOINTS

Pipe, Inches.	Solder, Ounces.	Pipe, Inches.	Solder, Ounces.	Pipe, Inches.	Solder, Ounces.
$\frac{1}{2}$	9	$1\frac{1}{4}$ water...	18	3 waste.....	24
$\frac{3}{4}$	12	$1\frac{1}{2}$ waste...	18	4 waste.....	34
1	16	$1\frac{1}{2}$ water...	20	4 vertical...	28
$1\frac{1}{4}$	16	2 waste.....	20		

For joints up to 2 in. diameter a pot containing 10 lb. of solder will be found large enough under ordinary circumstances. In some cases, however, such as where the joint is in an exposed position, or where the metals to be joined are brass, copper or iron, a larger quantity is absolutely necessary to get up and maintain sufficient heat. For 3-in. and 4-in. joints a large pot is required, especially for vertical joints.

The large cloth used in addition to the wiping cloth in wiping large-sized round joints is known as a "blanket" or "catch cloth" and is used to get up the heat by providing a much more convenient means of catching the metal and working it quickly around the joint. The cloth may be as large as the user desires or finds suited to him.

A certain amount of solder is wasted in every joint wiping operation, as in the process of pouring on and forming the operator's attention is given so closely to the joint that he is not always aware of the scattering of his excess metal in throwing it off. But a good mechanic is known by his waste and a judicious use of paper or boards placed to catch the surplus as it falls, will save money for the boss and trouble for the mechanic. When this is done the surplus may be safely picked up and returned to the pot. When it

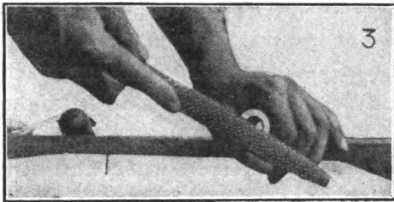
is allowed to fall on a bench where it may pick up brass or zinc filings and other scraps, there is a strong possibility of ruining the whole potful.

As before mentioned, the matter of keeping the solder from overheating must also be carefully attended to. When the tin is beginning to burn it may be known by the forming of dross on the surface, specks of which will be seen to turn bright red and smoke a little. The second result would be the melting of the lead pipe on to which it is poured or the burning of the tinning on a brass ferrule or union and consequent setting free of zinc from the brass to deteriorate the quality of the solder. The young plumber will soon recognize by the color or "bloom" on the molten solder when it is at the right heat or when he holds the ladle to his face by the heat thrown off and by intuition, as it were. Until he recognizes the signs he can take a piece of wood and stir his solder. It should be hot enough to char the wood slightly but not enough to burn it. This test will keep him on the safe side at least.

CHAPTER IV

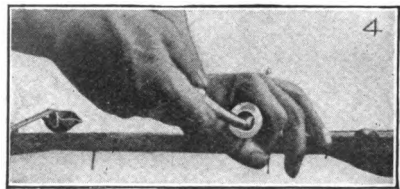
PREPARATION OF JOINTS FOR WIPING

THE preparation of the pipes for joint wiping must be carefully done, for it is important that while the joint should be strong and water or gas-tight, the bore of the pipe should not be reduced. The junction of the two pipes



Squaring end.

must be effected so that solder will have no possible chance of running through and forming an obstruction to the flow in service pipes or a sharp point that will catch lint or paper in waste and soil pipes. At the same time the fitting must be such that solder will not be merely built up around the outer surface of the pipe. This by no means constitutes a perfect joint, however well the building may be done. An annular space at the immediate junction which will allow of solder being sweated in to a point almost at the inner surface of the pipe is of more value in securing a joint that will successfully withstand heavy pressures, or movements caused by expansion and contraction than is generally known.

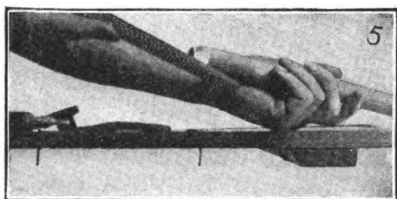


Removing burr.

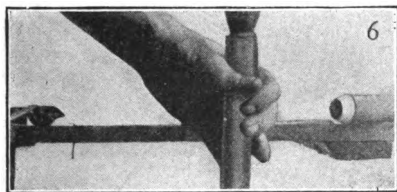
In hot-water piping, breakages are common, and consequently this point is of some importance. Breakages at the end of the joint are the most common and are caused by the different degrees of elasticity and hardness presented

by the solder and lead and the repeated stresses affecting the lead at its weakest point, weakened still more on frequent occasions by too deep shaving.

Unless the joint is properly proportioned, the difficulty of wiping it is increased to a needless extent. If a wiping cloth is made of a size to wipe joints 2 in. long properly, it is exceedingly difficult to wipe one that will be shapely and of correct weight if the cleaning be made 3 in. long. If a branch joint is prepared so that the cloth cannot easily reach both edges, a good looking joint will not be made without considerable trouble. It is therefore well worth the beginner's attention and trouble to find the length and shape of joint that suits him best and that



Rasping spigot end.

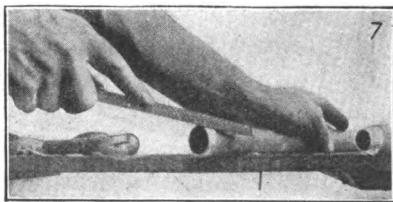


Expanding large end.

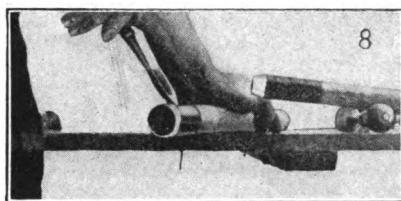
looks best to him, and carefully keep to that length and shape on every occasion.

What looks worse to an expert mechanic than a piece of lead work with a number of joints, no two of which are the same in size, shape or finish? And the labor is just the same, whether the preparations are made in a slipshod fashion or with ease and exactness.

The accompanying illustrations, Figs. 3 to 13, show all the steps in the preparation and setting up ready for wiping of a round joint. The first



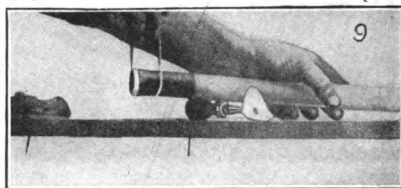
Rasping edge of large end.



Solling.

illustration shows the pipe being squared off after being cut from the roll. Whether it be cut with a saw or wheel cutter the end should be rasped square before beginning to form the shape required for the joint. This insures a good fit without the necessity of closing up the large end so tightly that solder cannot sweat into the junction. The taper on the small end should be rather long, as a short, blunt taper also prevents the sweating that is desired. This is shown in Fig. 14, which also makes clear the provision of an annular space as already mentioned.

The large end may either be widened with a turn-pin, as in Fig. 6, or bored out with a tap borer, as in Fig. 13. The former method is most generally used, and so long as the pipe is not distorted or stretched too much is possibly the better method.



Marking correct length for shaving.

Then the outer edge must be rasped off also. The rasp should be held so that the rasped edge when finished will be nearly in a parallel plane to the surface of the pipe. When this is done the solder need not



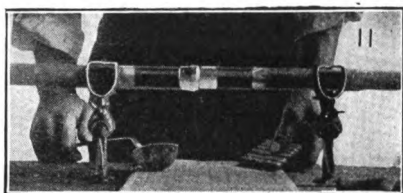
Shaving inside large end.

be so heavy over the point of junction and a lighter joint is possible without in any way reducing its strength or efficiency.

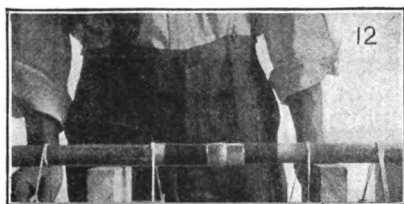
The third step in the process should be the re-

removal of all grease or oil from the pipe by rubbing the surface with sand, chalk or wire cloth. This admits of a clean surface being presented for the soil or paste, with less chance

of its being rubbed off in the process of wiping the joint. In soiling, a careful workman will always make a point of doing it to a line for the sake of appearance. A piece of paper tightly held around the pipe presents a clean and sharp edge to soil to and makes it a very easy matter to accomplish the work neatly and quickly.



Joint set up on clamps.



Joint set up with blocks and string.

is likely to run over and spoil the appearance of the work. Soil used to be made by the plumber from lamp black and glue in the following manner: Take $\frac{1}{2}$ oz. of pulverized glue and dissolve it in water, then gradually add a pint of dry lamp black with water enough to bring the whole to the consistency of cream. Boil and stir until the glue is thoroughly incorporated with the black. This will have to be done slowly, and when it has progressed far enough test it as follows: Paint a little of the soil

Soil is generally provided ready to mix with cold water, but when this is not available, old-fashioned shoe blacking will serve the purpose. It, however, will soften if exposed to a damp air and



Reaming out large end to fit spigot end.

on a piece of pipe, and when dry rub it smartly with your finger. If it comes off easily add more glue, but if it sticks and takes a slight polish it is good. If it curls off when heat is applied, there is too much glue in it, or the pipe was not cleaned before it was applied.

The length to which the pipe is to be shaved should be marked off, using the dividers as shown in the illustration. When shaving it should be remembered that it is totally unnecessary to remove any but the merest skin of lead to secure a thoroughly bright surface. Many men dig their shavehook into the pipe to an alarming degree and gouge out enough to impair very seriously the strength

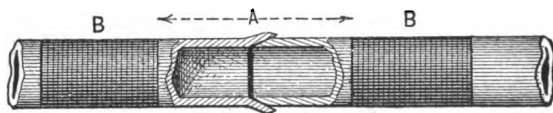


Fig. 14.

Section of prepared joint showing annular space at junction. A shaved, B soiled.

and durability of the job. When the surface is bright all over, and all scratches or pittings have been scraped out, tallow or lard oil should be immediately applied to prevent oxidation. Then the two ends should be tried together to see that a fit is made which will prevent solder getting through, and the inside of the large end having been carefully scraped and greased, the pipes are set up in position for wiping.

It is needless to enter into a description of the methods used to fix pipes for joints in their place on a job. The ingenuity of the workman must then be called into play, and with the usual nails, chisels, string, bricks and sundry pieces of wood he fixes them in a position which is to a degree satisfactory.

On a bench the fixing is an easy matter. Two methods are shown which are unsurpassed and which may be taken as representing the old and new styles of fixing. One of

the views, Fig. 11, shows the joint set up on clamps which may be purchased in the market, and which should be in the kit of every plumber who can secure them.

The second method, shown in Fig 12, is an old-fashioned one that calls for only eight nails and about three yards of string. With a box cover or similar board placed on the bench, the joint is set on it, and bricks or square wooden blocks used as rests for the pipe. Then the nails are driven into the board a few inches out from the center line on each side and at spaces about 8 in. apart. Attaching the string to the nail at the end, the plumber takes a turn around the pipe with it and twists it around the nail opposite. Then it is carried along to the next nail and the operation repeated until it reaches the last. Here it is tied so that it cannot slip. The fastening is absolutely secure and there is nothing in the way of hands or tools to prevent their free use.

Whether these or other methods are employed it is important that no movement be possible, either laterally or outwards from the junction, as this would endanger the success of the joint. Most beginners at one time or other manage to make a solid joint, i. e., close up the bore of the pipe with solder, and it is more often made by an insufficient fixing than by a hole burned in the lead.

CHAPTER V

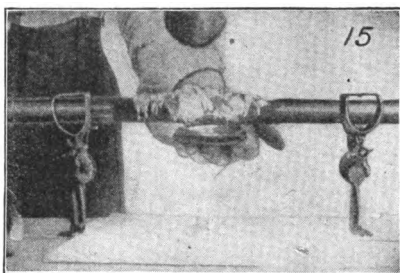
ONE-HAND AND TWO-HAND METHODS OF JOINT WIPING

WHEN a joint has to be wiped in a cramped place rendering the free play of the hands impossible, as well as preventing the accumulation of the proper quantity of metal to get up a tinning heat, it is an excellent plan first to tin the joint with the soldering iron. This adds greatly to the chances of the joint being tight. In making joints on brass, copper or iron pipe this, of course, is always done, but it is not often done on lead, unless the cleaning must be made some time before the joint is to be wiped or under the circumstances described in the foregoing. In new work the mechanic can generally manage so that his joints will come in a handy place, but in making repairs this choice of location is impossible.

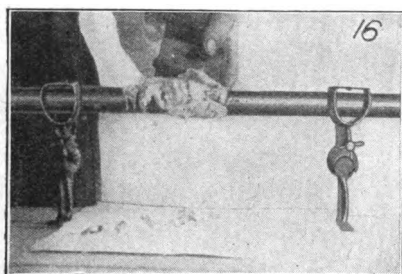
The joint made on the bench or floor, or in fact wherever there is room and light, is easy enough. When it has to be made in corners, overhead, or under floors, however, with perhaps an iron steam or waste pipe in the way, and occasionally where parts of it cannot be seen without the aid of a small mirror, and where the whole knowledge of how good or bad it may be depends on that and the feeling with finger tips, conditions are somewhat different.

As has already been stated, there are two general methods of making a round joint and each requires description, so that the beginner may choose which he prefers. The first to be described requires the use of two hands in making the final wiping and, in addition, the use of a small cloth to assist in forming. Begin by using a cloth of the size given in the table in Chapter III and shave the joint to the length given therein. This is quite important. See that the pipe is firmly fixed on its supports, so that it will not move in any direction.

Hold the wiping cloth in the left hand, keeping the thumb over the top and lightly gripping the cloth with the middle fingers depressed to form a hollow which will retain the solder on the cloth. Hold it an inch or two below the joint, and after stirring and skimming the solder thoroughly, pour on the joint and for an inch or two on each side of the cleaning in a dropping stream, as shown in Fig. 15.



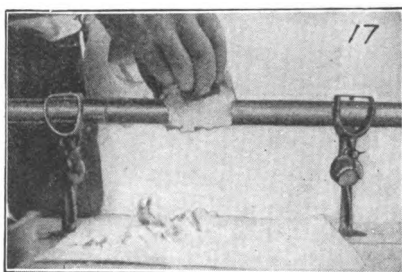
Pouring on.



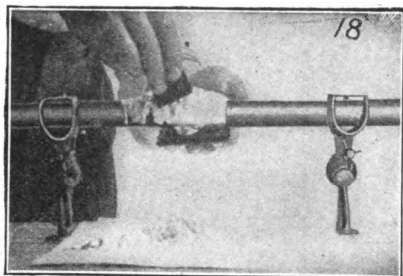
Bringing surplus to top of joint.

keep bringing it up the near one, until you judge you have a sufficient body of metal at a heat that will insure time to manipulate it before it sets. This operation is portrayed in Fig. 16.

Then drop the ladle and pick up the small cloth previously mentioned, and holding this in the right hand, the wiping cloth in the left, reach over the joint with the small cloth and with a movement of each hand



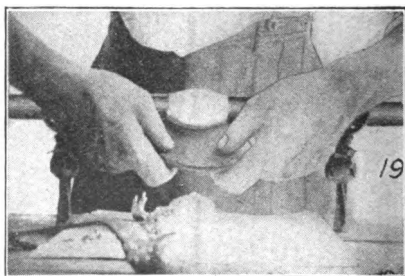
Forming.



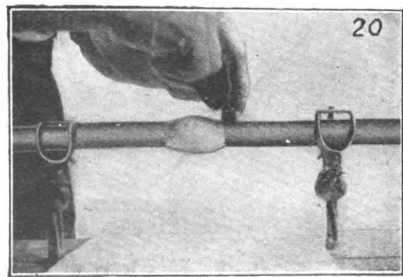
Cleaning edges.

throwing all the hot solder into the wiping cloth—Fig. 18. This surplus solder is immediately stuck on the lower side of the joint and roughly molded to the proper shape by a pat or two of the cloth.

Then drop the small cloth and, taking the wiping one in both hands with the fingers in position, as shown in Fig. 19, and the thumbs lightly holding each edge to give a hollow shape, reach around the joint as far



Wiping.



Finishing.

bring the metal to the top of the joint as in Fig. 17.

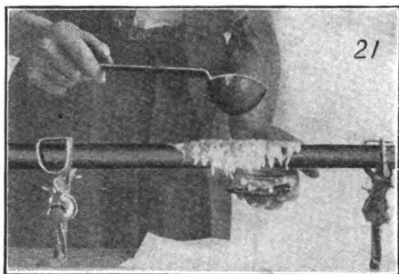
Hold the larger cloth under the joint and with the small one clean off the surplus solder to each edge and roughly mold what is left on top to the shape of the joint,

as you can and swiftly wipe towards you until you come to the highest point you can reach. Then turn your thumbs to the back of the cloth and with the forefingers pressing the cloth to form the hollow, continue the motion until you reach the point where you began to wipe. The action of turning the thumbs is hard to describe either in words or pictorially, but easy to perform in practice. Re-

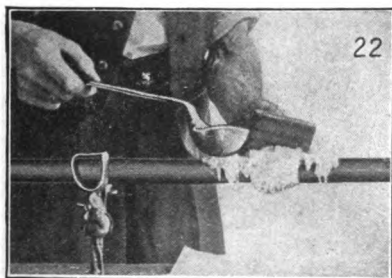
peat the operation, and when the highest point is reached sharply throw the excess metal off at a tangent.

If you have heat enough the slight ridge that is left will sweat in and leave the finish invisible; if not, lightly draw it to one side with the cloth, as shown in Fig. 20.

Some mechanics prefer to wipe in the reverse direction, that is, they reach around the joint from the



Pouring on.

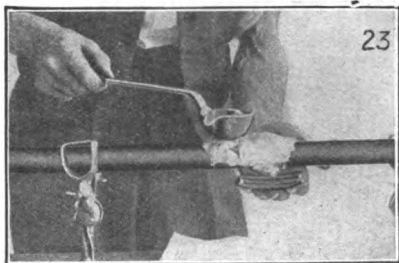


Bringing solder to top.

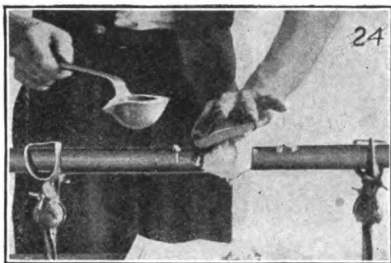
under side and wiping toward them, turn the thumbs when the high point is reached and push the cloth over the far side with the thumbs behind the cloth.

The advocates of the two-hand system claim for it: An equal heat throughout the metal owing to the method of forming, thus keeping the tin equally distrib-

The action is identical with that just described, only some men



Forming by aid of ladle.

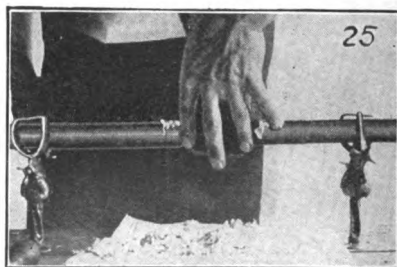


Cleaning edges.

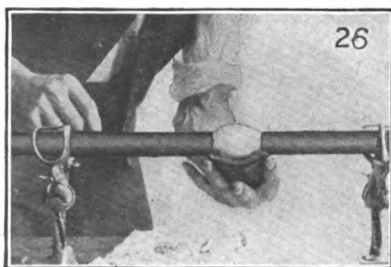
down of the particles of slowly cooling solder in layers one over the other and in the same direction by reason of the wiping motion being all in one direction. The continuous direction of wiping motion is less likely to draw tin from the bottom and leave it on the top of the joint.

This last item is of importance in securing joints that will not sweat under heavy pressures.

In wiping a round joint with one hand only the first two operations, Figs. 21 and 22, are similar to those described in the two-hand method, the solder being poured along the pipe to get up



Wiping one side.



Wiping bottom and near side.

uted; a better-shaped joint owing to the ease with which the wiping can be performed in a perfectly straight line with the cleaning with two hands as against the diagonal motion that is often given when only one is used; a laying

and maintain a heat and the flowing of solder down the far side and bringing it up the near side being the same. Instead of using a small cloth, however, to clean the edges, the operator uses his ladle, which melts the surplus solder down, and

he pushes this over to the far side with a diagonal stroke, meeting it with his wiping cloth and molding to form with a few pats, as shown in Fig. 23. Then with the cloth held as in Fig. 24 he rapidly cleans around each edge, paying small attention to the center of the joint, but getting the edges smooth and straight. Then reaching over the back and as far around the under side as he can get, with the fingers in position as in Fig. 25, he wipes upward and toward him until he passes the highest point. Then he turns his hand and performs the same operation on the near side, Fig. 26. He repeats these operations as often as necessary, or as his heat will allow him, and with a final flick of the cloth as it reaches the high point he throws off the surplus and allows the slight ridge to sweat in as before or wipes it to one side as his fancy dictates.

For the one-hand system the following claims are made: Easier wiping of short brass connections or of joints on traps where the "tail" is short; easier working of very fine solder owing to the shorter cleaning.

Either system requires skill of manipulation and a knowledge of the peculiarities of solder to get first-class results, and if the joint is well tinned, well formed, of sufficient weight, and above all, water-tight, it matters little by which method it is wiped.

CHAPTER VI

WIPING JOINTS BY ROLLING METHOD— TINNING BRASS WORK

THERE is a method of wiping joints, which, when expertly performed, gives an almost perfect shape and finish. A joint can be made as true to shape almost as if it had been turned on a lathe, and where an especially good job is desired for some exposed work this method is often followed. It is known as the "rolling" method, the term being amply descriptive.

When it is intended to wipe a joint in this fashion the parts should be prepared in the usual manner and then burned together to insure rigidity. This is accomplished by using a good hot soldering iron and melting the edge of the lead so that it will adhere firmly to the other piece, or to the tinning of the ferrule, or other part as may be the case. To strengthen the joint in this burning process still further, a thin, clean strip of lead in addition may be used to build up a little body in burning. An alcohol torch offers a very convenient means of burning these parts together and is superior to the iron in that it does not oxidize the parts heated so readily.

Should the part to be wiped to the lead pipe be a ferrule or soldering nipple, another method of securing a perfectly firm fixing may be adopted. Cut a number of "splints" or pieces of lath about $\frac{1}{4}$ in. square in section and about 10 in. long. These are pushed through the ferrule and into the lead pipe about 3 in., and a piece cut with a tapering shape inserted in the center of the bundle will firmly wedge them and cause them to spread out against the interior surface of the pipe and ferrule, thus holding them in a perfectly firm manner.

The pipe is laid on bricks or blocks of wood, pieces of 2 x 4-in. studding generally, to permit of its rolling easily for a distance equal to or greater than its circumference. Weights laid upon the pipe, or pipe wrenches laid so that the jaws lightly grip the pipe while the handles touch the bench on opposite sides, afford a means of steadying the pipe while the operations of pouring on and rough molding the joint are being accomplished, and these are instantly removable when the rolling operation comes on. This method is shown in Fig. 27.

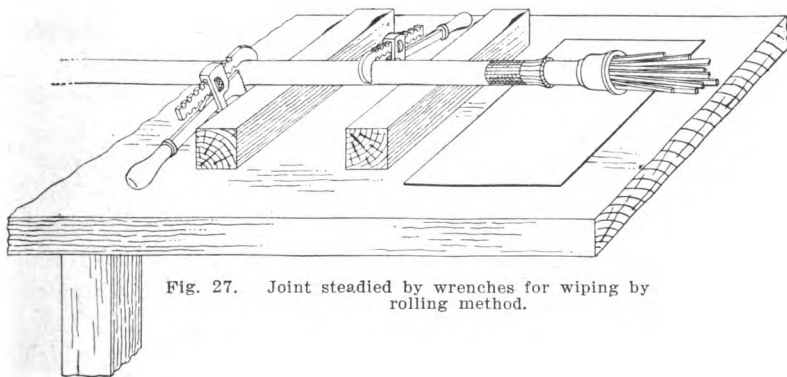


Fig. 27. Joint steadied by wrenches for wiping by rolling method.

If the operator intends to wipe the joint with his left hand, he must steady the joint on the bricks so that it will be in a position convenient for this, with room for him to roll with his right hand. If he prefers to wipe with his right hand, he must steady his joint accordingly, with the cleaning placed at the right-hand end of the blocks. When he is satisfied that he has sufficient heat and body of solder to make a good joint, he rapidly removes his weights and rolls the pipe to the edge of the blocks nearest him. Then holding his cloth with one edge and pressing the edge of the joint on the lead side, he quickly rolls the pipe away from him. Then he rolls it back, and repeats the operation on the brass side. If he has too heavy a body

of metal left he rapidly wipes the superfluous solder off to the lead side and again wipes around this edge. Then holding his cloth so that a finger presses each side, the middle finger being raised to preserve the correct hollow in the cloth, the operator smartly rolls the pipe away from him again, and repeats the operation as often as necessary or as his heat will permit. If he finishes the operation quickly the slight ridge of solder carried around with the cloth will sweat in and leave an invisible finish. The cloth must be smooth and flexible and it is important that the cleaning should be of the correct length to suit the size of cloth used.

Before entering on any description of joints between brass ferrules and lead pipe a few hints on the proper tinning of brass work for wiping may be acceptable. It should be realized that too much care cannot be given toward securing a thorough tinning of brass or copper pipe, brass ferrules, unions, stopcocks and the like, when preparing them for wiping to lead pipe. If the surface is not thoroughly clean and free from oxidation, or small pits and scratches are overlooked, the joint will probably leak under high pressures or give out in a comparatively short time, owing to the corrosive influences of gases or water which have been allowed to begin their action at the untinned spots. Therefore use the file carefully and although it is not desirable, or indeed often necessary to reduce the thickness of the brass or copper to any extent, at least see that the surface is perfectly bright before tinning.

As soon as the filing has been completed, rub the surface with powdered rosin and after soiling to the correct length or pasting on paper, if such is preferred, tin with a moderately hot iron. If the iron is too hot it will draw the zinc out of the brass and not only make a poor tinning, but tend to spoil the solder when the joint is wiped.

The ends of all ferrules should be tinned, whether they are fitted inside or outside of the lead. If inside, and especially in hot-water supply work, the inside bore of the

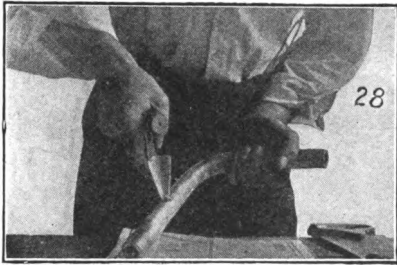
coupling or ferrule should be cleaned and tinned also as far up as can conveniently be reached. This is to retard corrosion or eating away of the tinning, and is of value in securing a joint that will last.

To counteract the tendency of the solder to sweat through in the wiping process and form beads on the inside of the brass work, this inside tinning can be soiled over so that drops which might happen to get through would not adhere. It may be well to emphasize the value of this careful tinning in hot-water work, for whether it be owing to excess of oxygen or to the constant movement from expansion and contraction to which the parts are subjected, there is no doubt about the liability of joints to give out frequently in this class of work, and it is generally found in such cases that the tinning is badly corroded.

CHAPTER VII

PREPARING BRANCH JOINTS FOR WIPING

THE preparation of branch joints is a matter that must receive as careful attention as that of round joints; in fact, in some cases more skill and care are needed. If

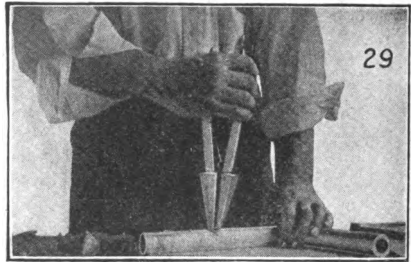


Boring hole for branch.

these joints happen to be on a waste or soil pipe, a badly fitted spigot end may mean an insanitary job owing to the solder getting through and forming obstructions; or it may be that the branch will project into the bore of the main pipe and reduce the passageway, both of the branch and of the main flows.

It will be seen, therefore, that the importance of careful workmanship is not overestimated and that a pretty joint over a bad fitting is not really the sign of the expert, but that of the careless man who could do first-class work if he would take the necessary time.

The same thing applies to the heavy pipe used for water supply. In widening out the hole for the branch the lead



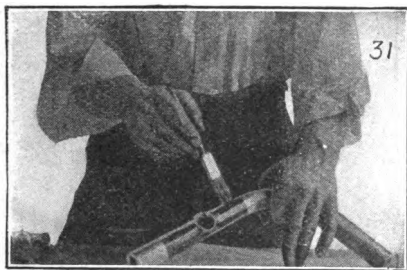
Widening hole with expanding pliers.

may be upset with the bending iron so that the waterway is seriously reduced, or again the spigot end may project so far into the main that the result will be the same. Also the

point of the iron may have been carelessly handled and the inner walls of the pipe dented and weakened.

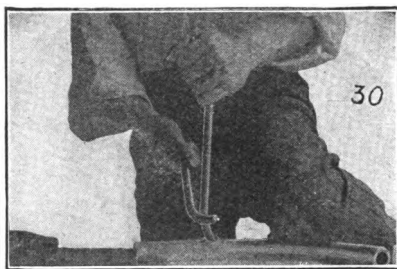
It is always much better to take a little trouble to assure yourself that the fitting is good rather than take chances of stopped wastes or insufficient water supply.

The first operation in preparing a branch joint is the squaring off and rasping to a taper of the spigot end.



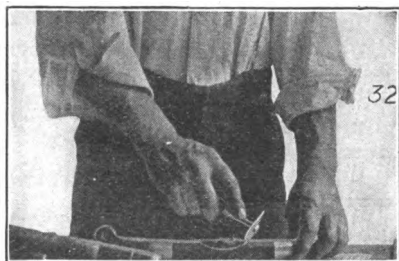
Soling the parts.

in using this tool that it is not driven so far in that it will damage the inside wall of the pipe opposite the hole. If the branch is a water pipe of $\frac{1}{2}$ in. to 1 in. size, a hole of $\frac{1}{2}$ in. to $\frac{5}{8}$ in. in diameter is ample. If for waste pipe, a larger hole, proportional to the size of the pipe, must be made. In either case it must be kept small enough to



Setting up sides with bending pin.

This operation is identical with the preparation of the same part in a round joint. The next is boring the hole in the main pipe into which the spigot is to be fitted. This is easily accomplished by using the tap borer, as shown in Fig. 28. Care must be taken

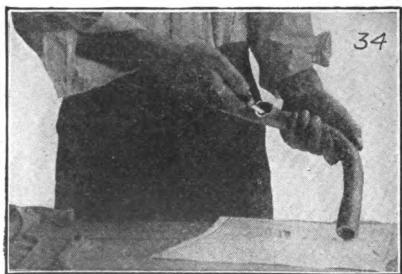


Marking off for shaving.



Shaving the parts.

allow the metal being upset to provide surface enough in contact with the rasped edge of the spigot end to insure a good joint. The process of upsetting is shown in Figs. 29 and 30. Fig. 29 shows the use of the expanding pliers in widening the hole and giving the lead a tendency to curl upwards. This is followed by the bending pin. This tool is held in such a position that light strokes of the hammer will lift the lead upward instead of merely beating it back. When properly performed the section of the main pipe at the branch appears as shown in Fig. 35, thus reducing friction to a considerable extent.



Turning off burr made by bending pin.

When a good fit with the spigot end has been obtained, the inside should be lightly scraped with a small knife to remove any unevenness, as shown in Fig. 34. Before soiling, as shown in Fig. 31, the parts should be rubbed with sandpaper, wire cloth or chalk to remove oil and grease. When the soil is dry, the length of the shaved part should be marked off. This may be done by using the shavehook, as shown in Fig. 32, the rounded part being used. With a little practice, one may learn to mark off every joint to nearly the same proportions, but to

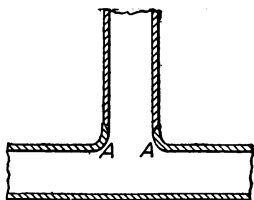


Fig. 35

Section of well-prepared branch joint.

obtain accuracy and a good appearance it is advisable to use a gauge and compasses. Figs. 36 and 37 show the appearance of joints with the cleaning badly proportioned. It is also much harder to wipe these.

Any plumber can make a gauge which will give him accurate proportions for each of his joints, and it will save time as well as help him to do better work. Take a piece of heavy sheet brass or iron and cut it to the shape and sizes given in Fig. 38. With a sharp point

describe a vertical line from the point A. Draw through this a line at right angles from point B to C. Mark off points $\frac{1}{8}$ in. apart, beginning $1\frac{1}{2}$ in. above the horizontal line. The point A should be $\frac{5}{8}$ in. below the horizontal line. Now drill very small holes through these points. These need not be larger than $\frac{1}{32}$ in., as they are simply required to steady one leg of the dividers. The lowest hole above the horizontal line represents $\frac{1}{2}$ in. pipe. The points above represent an increase of one size to each point. The dividers are set from point A to the point representing the size of pipe being used. For instance, if 1-in. pipe were used, the dividers would stretch from A to the third hole.

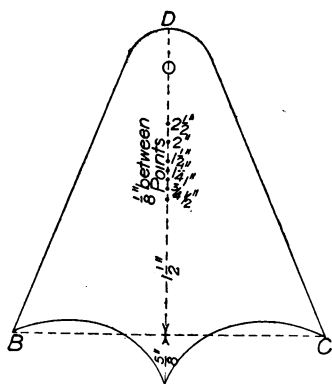


Fig. 38

Gauge for marking size of joints.

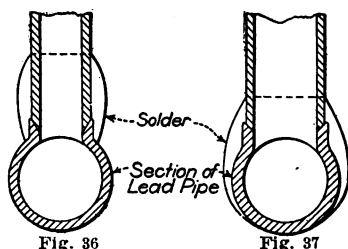


Fig. 36

Fig. 37

Section of badly-proportioned branch joint.

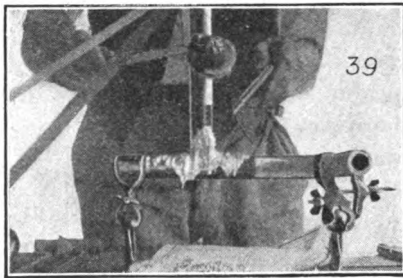
To use the gauge, set the point A directly in the center of the hole in the pipe (which, of course, must be nicely

rounded) with B and C resting on its surface. It is held vertically while the dividers are inserted in the correct hole and a circle described from that point on the pipe. The spigot end is shaved for a distance of $1\frac{1}{4}$ in. from the end. This size is adhered to for all the various sizes of pipe. The resultant shape of the joint is good and ample weight of metal is allowed at the points where it is most necessary. Should the operator wish to lengthen the cleaning of either spigot or main pipe, he can very easily do so by using the hole above the size intended when marking off. When shaving is being done, care should be taken not to cut too deeply into the metal, and immediately the cleaning is finished it should be covered with tallow or lard oil.

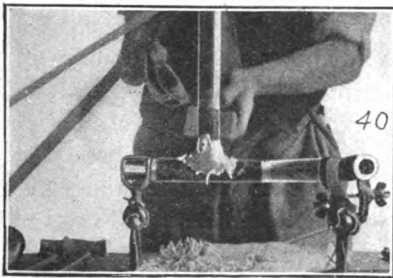
CHAPTER VIII

WIPING VERTICAL AND HORIZONTAL BRANCH JOINTS

THE majority of plumbers find it easier to wipe a branch joint in the vertical position, such as is shown in the illustrations Fig. 39 to Fig. 48. It will be noticed in these illustrations that pipe clamps are used to steady the parts, and the use of these tools is to be recommended as they allow of free use of the hands and cloth when wiping and insure that solder will not get into the pipe by reason of the branch pipe pulling out of its proper position during the operation.



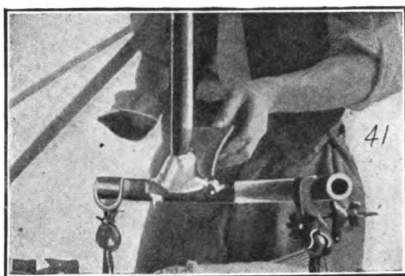
Pouring on far side.



Pouring on near side.

The first step in wiping a branch joint consists of pouring solder on to the shaved part and for a few inches on either side of it; this being accomplished by holding the cloth at an angle which will throw the solder to the point desired when it is dropped upon it from the ladle. This is done on both sides and ends as

shown in Figs. 39 and 40, and as heat is raised and the metal begins to flow, it is kept worked up to the cleaning by using the cloth as in Fig. 41.

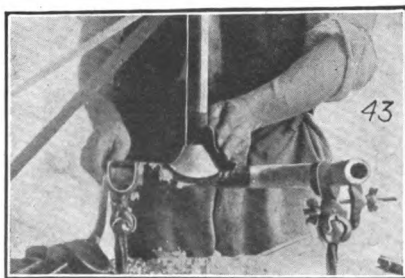


Rough molding.

When the operator is sure he has sufficient heat and solder enough to form a joint of the proper weight, he roughly molds it with a few pats of the cloth and proceeds to make the first wiping stroke with the cloth held as in Fig. 42. The middle finger is depressed when the cloth is being brought around the end of the joint, as shown in Fig. 43, and is gradually raised as it comes around to the side, and is depressed again as it reaches the other end. It will be seen that by reaching around the joint the wiping stroke begins at one end. The convenience of this method will be noted on the finishing, as the joint may thus be made with one long motion and the surplus solder thrown off with a sharp flick as the end is reached. This will give a smoother finish than if the wiping were accomplished with several distinct motions.



Beginning the wiping stroke.

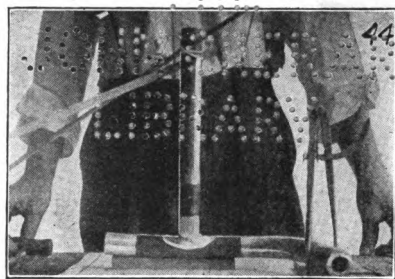


Wiping at end, showing middle finger depressed to form hollow.

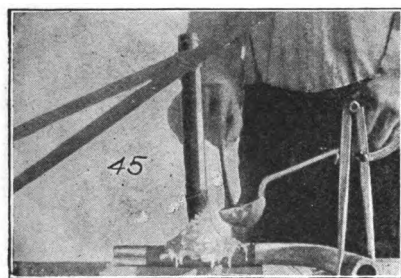
But if the edges have not been found in the wiping, it will be necessary to go back over it another time, and should the heat not be great enough to sweat in the finishing ridge, a light cross wipe will leave a neat finish.

Another method of steadying a branch joint often practised to the detriment of dividers is shown in Fig. 44. In this view, however, is shown the use of small blocks of wood under the branch for the purpose of preventing sagging.

This keeps the pipe up far enough from the bench to make the wiping easy, and at the same time prevents the pipe from settling down as the heat softens it. When the branch



Method of steadying vertical branch.



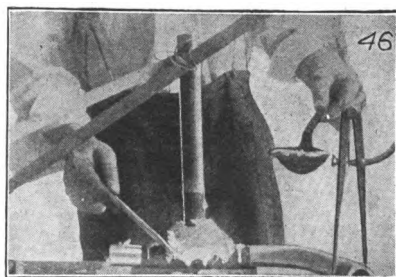
Splashing on solder to get up heat.

pipe is of some considerable weight, this point must receive attention, otherwise a good-looking job will not be secured, and the hole in the main pipe will be also distorted and possibly lead to solder finding access to the inside of the pipe.

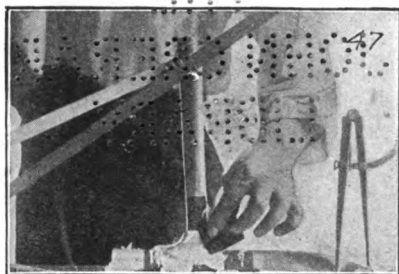
The use of the splash stick in getting up a heat is also shown in these illustrations. This method of applying the solder to a branch joint is often more convenient than the other in making joints in position or where a short bend on the branch pipe would interfere with pouring it on from the ladle.

The method of wiping the joint shown in Figs. 44 to 48 is also a

The use of the splash



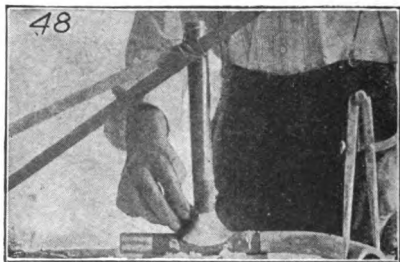
Drawing up solder with splash stick.



Wiping around top edge first.

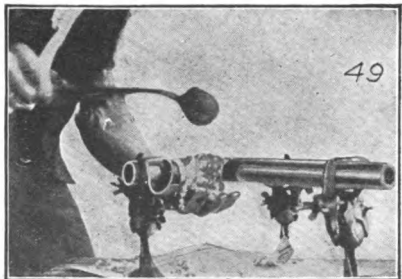
wipe at the finish. The fingers are depressed at the ends so as to form a hollow, thus relieving the pressure at the sides so that the correct shape and weight of joint are obtained.

The joint shown is on a $\frac{3}{4}$ -in. pipe and is marked off to the sizes which the gauge will mark, namely, $1\frac{1}{8}$ in. cleaning above the horizontal surface of the pipe and $2\frac{3}{4}$ in. in total length along the main pipe.



Final wiping stroke.

Should it be necessary or desirable to wipe the branch joint in a horizontal position, the pipe clamps will be found a very convenient means of steadying the pipe and ample room will then be provided under it. If they are not available, blocks of wood with weights or string and nails, as described for steadying a round joint, may be used.



Pouring on.

The solder is poured on exactly as if a round joint were to be wiped, the solder being allowed to flow down the sides farthest from the operator and brought up to the top of the joint again over the near side, as shown in Figs. 49 and 50. Thus a strong heat is very quickly developed, and as soon as the amount of solder in a properly plastic state is available, the first wipe from the bottom to the top of the joint is made.

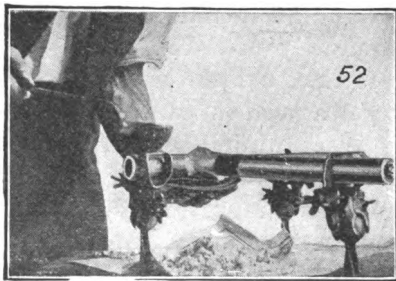


Bringing solder up over front of pipe.



Wiping one side up from bottom to top.

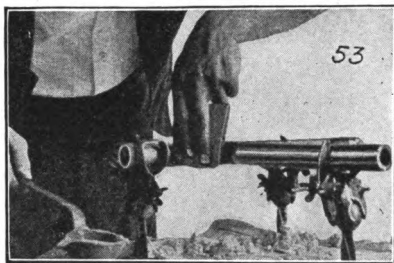
This is shown in Fig. 51. The solder that is drawn to the top of the joint by this motion is pushed on to the cloth by the aid of the ladle and is stuck on the bottom again. The wiping is repeated on the same side and then followed by a similar motion from the bottom up the other side. If the fingers have been held so that the cloth reached the cleaning properly, all that will remain to be done will be to cross-wipe the excess solder from the branch pipe toward the operator. This should be done carefully and lightly, so that as narrow a wiping mark as possible will be made.



Drawing superfluous solder from top and sticking it on bottom.

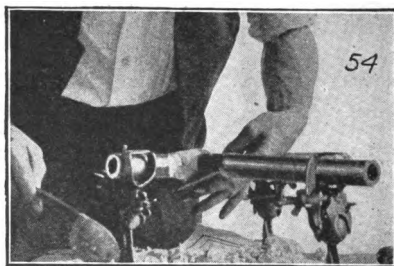
This will give a much better appearance than if the cloth were pressed heavily on the solder. This style of wiping branch joints should be cultivated, as it is one that is exceptionally useful in wiping joints in position.

Wiping a joint with the branch pipe in a horizontal



Final wipe from bottom to top.

position and the main pipe vertical is probably the hardest proposition that is met with. The method is very similar to that just described, but it has to be done from a different position as a rule; that is, instead of being behind the main pipe, the operator will generally be in front of it, and this makes it harder to get a good shape in bringing the cloth around. In a case where a branch is to be taken off a rising pipe already in position, the ability to wipe such a joint is a useful accomplishment and therefore it is worth some trouble to master it. The cleaning on the branch pipe might be made a little longer than that which would be used in a vertical or horizontal joint as already described, as it is then a little easier to get a good shape.



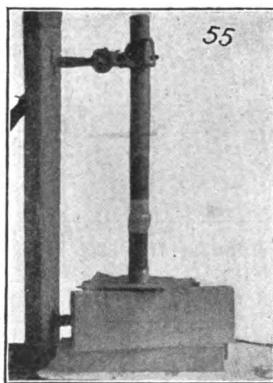
Finishing wipe from bottom to top, then cross wipe to remove ridge.

When wiping in a new bibb-cock it is a simple matter to melt off the solder from the old one and insert the new faucet, wiping it in this fashion. This will often save damage to sink flashings, as the pipe need not then be removed.

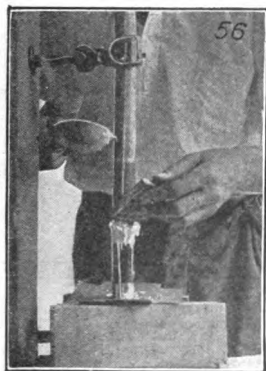
CHAPTER IX

WIPING VERTICAL ROUND JOINTS, FLOOR AND WALL FLANGES

WIPING a vertical round joint is to many men a more difficult operation than wiping the same joint in a horizontal position. This is especially true if the joint happens to be in a cramped position, and it must be admitted that more skill and quickness are required for this style of wiping. It is harder to get up a heat equal to that on a horizontal joint and keep the solder from falling down. The inexperienced man therefore is liable to begin wiping before he has sufficient heat to carry him through, and the consequence is freez-



Joint steadied by clamps for wiping in vertical position.



Pouring on.

ing on the edges and setting of the solder before he has had proper time to mold and wipe the joint into shape. On the other hand, he may pour metal on the pipe so long that he raises too much heat, when the tin will leave the solder and set along the lower edge, or the solder will be in such a fluid state that it will be next to impossible to mold a joint of the correct shape. Here again only practice will avail to make perfect.

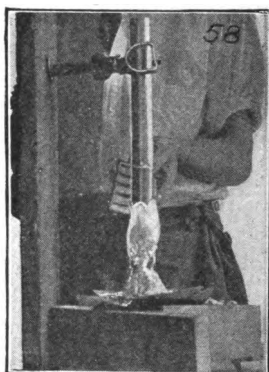
There is but little variation in the methods of different men in wiping vertical joints. Certainly there are differences, but only in minor points and on the whole the views



Drawing the solder up.

shown here cover the operation as performed by the majority of good mechanics.

A joint set up and steadied with the aid of clamps is shown in Fig. 55, supported



Drawing the solder up on back.

on a bench in exactly the same position as it would be on a job. Several of the views show the blocks which served to support the cardboard solder catcher removed to show the



Rough molding.

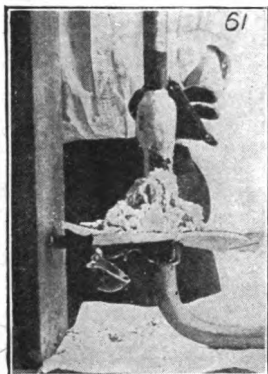
lower clamp. Fig. 56 shows the method of pouring solder on the joint by the use of the wiping cloth held at such an angle that the solder will be directed to the



Rough molding.

part required. An alternative method is to use a splash stick to throw the solder on to the joint. This is a very

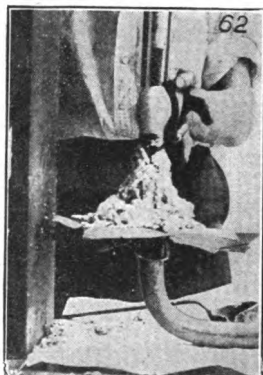
convenient method in cramped positions, for instance, in wiping a new S trap on to a waste pipe under a fixture. The metal may also be thrown on the joint from the



Wiping top edge.

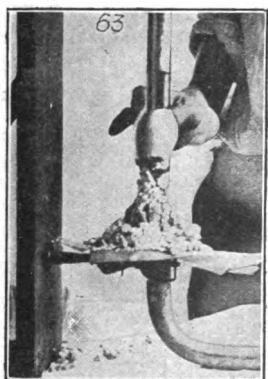
ladle by giving it a jerky motion, but this requires great care when the solder is very hot.

The next motions are shown in Figs. 57 and 58. These are the ac-



Cloth held correctly in wiping from far side around left to front.

tions of drawing up the solder on the shaved parts, as the tendency to slide down grows with the heat. The solder having been drawn up so that a good



Wiping around from far side with right hand.

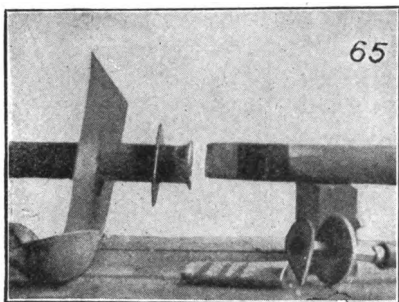
body is over the cleaning, the cloth is taken with the edges held by the fingers and with the middle finger raised to form a hollow, the operator roughly molds the



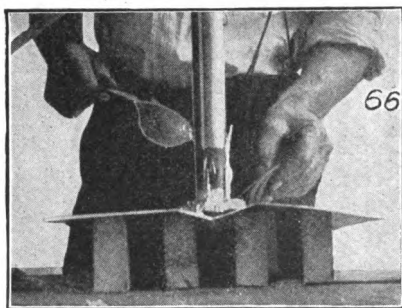
Finishing wipe—throwing off solder.

joint as shown in Figs. 59 and 60. Having obtained the rough shape and approximate weight desired, the top edge

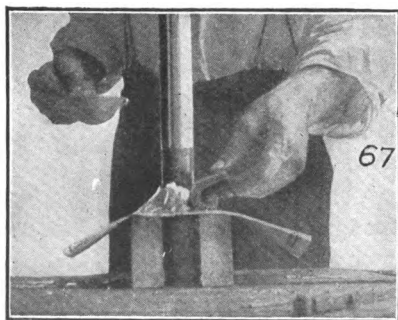
is quickly wiped clear around the joint with one motion of the cloth and with the fingers held as in Fig. 61.



Parts ready to set up.



Commencing to pour on solder and forming with cloth.



Working up heat by pushing solder into wiping with cloth.

The next step is the final wiping one, and is made by holding the cloth again so that it will form a hollow and pressing one finger on each edge of the cleaning as in Fig. 62. The wiping stroke should begin as far around as can be reached and should be as long as possible. Many men can continue it until the starting point is reached, when the surplus solder is sharply thrown off, leaving a little ridge which quickly sweats in and leaves a smooth finish.

If preferred, or if more convenient, the cloth can be changed into the other hand and the finish made on the near side as is shown in Figs. 63 and 64.

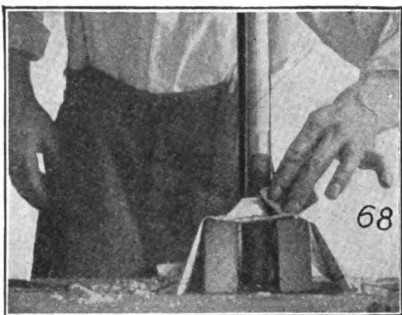
If a cross wipe is made to remove the ridge of solder, it should of course be made from the top edge downward and should be as narrow as can be made to secure a smooth finish. The solder around the joint should be removed in

part at least before it has time to set, but care should be taken in doing so not to jar the joint.

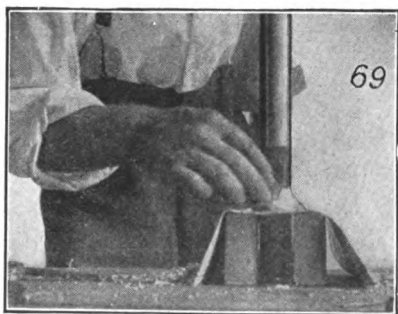
The cardboard catcher is simply a piece of box with a hole in it slipped over the pipe before the parts are put together. It offers a convenient means of keeping the solder around the pipe and aids greatly in maintaining a proper heat.

Probably the easiest joint of all to wipe is the floor flange, but as it is one that, if badly made, will spoil the appearance of an otherwise good job, it deserves just as much attention as that of any other style.

It is seldom made on the bench, as in nine cases out of ten it is made as a convenient means of connecting up the lead work installed in the finishing of a plumbing job to that put in when "roughing." The accompanying views show a joint being wiped on the bench merely for convenience and clearness. Where lead wastes and vent pipes from fixtures, such as lavatories, sinks and laundry trays, pass through the wall or floor, some sort of flange is necessary to hide any uneven fitting of woodwork to the pipe, and this also serves as a support, preventing sagging of bends. Therefore this

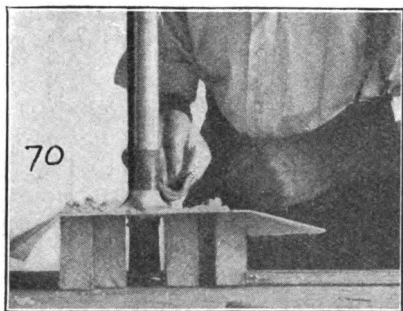


Position of fingers to obtain correct shape.



Wiping the right side.

combination of flange and junction of pipe is admirable. As the difference between wiping a wall flange and a floor flange joint is considerable, examples of both will be



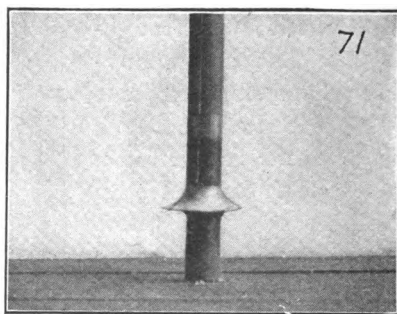
Finishing by cross wipe.

shown. The floor or vertical flange, which is the simpler of the two, requiring no special skill in handling the solder to form and retain it in position while wiping, will be shown first.

The parts are prepared as shown in Fig. 65 with the spigot end rasped off, shaved and

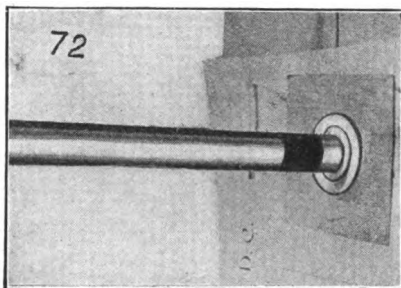
soiled as for a round joint, the cleaning being about $1\frac{1}{4}$ in. long.

The pipe projecting through the floor is cut off, leaving about $\frac{3}{8}$ in. clear of the surface and the outside is shaved. Then a ring of lead cut from the sheet or a piece of waste pipe split and dressed flat is prepared. This flange should fit over the projecting pipe snugly and should be $1\frac{1}{2}$ in. greater in diameter, thus giving a ring $\frac{3}{4}$ in. wide. One side and the outer edge of the ring should be soiled and the other side and inner edge shaved bright. This should then be slipped over the projecting pipe after first putting down a piece of cardboard or thick paper to prevent charring of the woodwork by the hot solder and the end of the pipe expanded by the



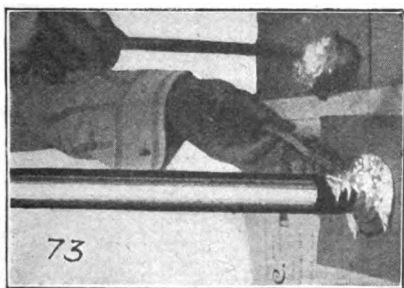
Finished joint.

turn-pin or expanding pliers. Then with a wooden mallet or dresser, the end is turned over and dressed down flat on the flange. Shave the part now exposed, scraping down into the pipe as far as the spigot part will reach. After the bright parts are rubbed with tallow or lard oil and the pipes set up in position, the joint is ready for wiping. Care should be taken to secure a good fit, as these joints are generally made very hot and sharp needles of solder may find their way through.



Ready to wipe, with paper and cardboard protection in position.

The preparation of wall flange joints is identical, but it may be found somewhat easier to wipe the latter if the cleaning on the spigot part is made a little longer than $1\frac{1}{4}$ in. The sizes given, however, do make a neat and well proportioned joint.



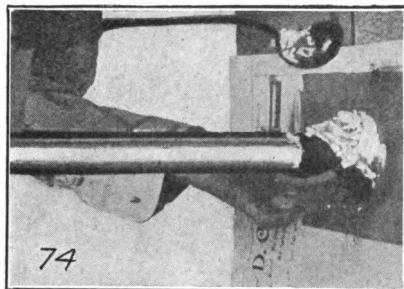
Pouring on solder.

Wiping is begun on a floor flange by pouring the solder from the ladle directly upon it and keeping it from flowing away by using the wiping cloth to direct the flow of solder back to the flange as shown in Fig. 66. In Fig. 67 the operator is shown pushing the plastic solder up on

the pipe, thus heating it up and at the same time roughly molding the joint. When a good body of metal with sufficient heat is secured, the cloth is taken with the fingers held as in Fig. 68, pressing the edges to form a hollow,

and reaching around the joint, a long sweeping wipe is made.

When the stroke has been made as far around as is convenient, the cloth is changed to the right hand and the other side is wiped as in Fig. 69.



Working solder up from bottom to top of joint.

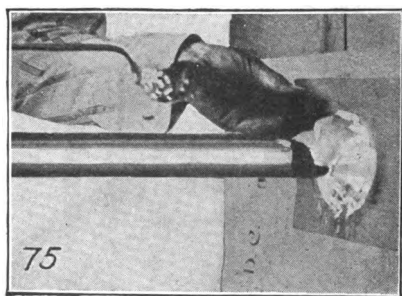
At the end of the stroke the light ridge of solder remaining is wiped off by a cross wipe from the pipe to the outer side of the flange as in Fig. 70.

The finished joint is shown in Fig. 71 and of course, in position, it would rest on the floor boards. Immediately on finishing wiping the excess solder should be pulled clear of the flange. If the edge has been properly soiled this will leave a clean sharp edge and the solder will leave the lead easily. The cardboard should be left until the solder is cold and easily removed, so that the woodwork will not be marked by the heat.

When the flange joint is to be wiped against a wall, the wood or plaster should have ample protection and a large sheet of paper should be in-

serted before the projecting piece of pipe is dressed over on the flange, as shown in Fig. 72.

From the views it will be seen that there is likely to be considerable spattering of solder and the results of



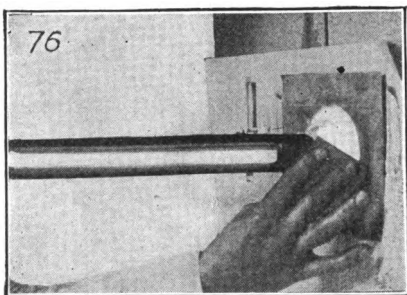
Bringing solder up from bottom to top of joint.

leaving the wall unprotected are obvious. Heat is raised by pouring the solder on the pipe in a manner similar to that when wiping a round joint, but when commencing the operation it will be found convenient to hold the cloth at an angle and pour on to it as in Fig. 73.

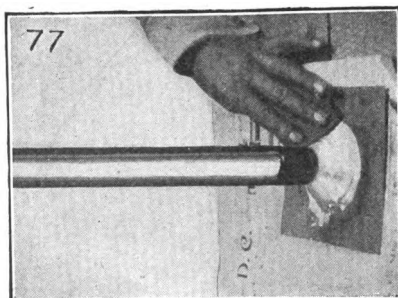
This will direct the solder on to the flange as well as on the pipe and will build up a small body of solder which will flow around and tin the flange thoroughly.

In Fig. 74, the cloth is being held under the joint and solder is being poured directly upon the pipe. As the molten metal flows down the far side it is caught in the cloth and brought up the near side to the top and deposited there.

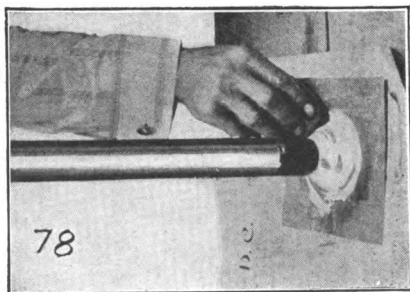
Fig. 75 shows this being done. The pouring on and drawing up from the bottom should continue until a body of thoroughly hot solder has been secured, when wiping is commenced with the cloth held as in



Commencing the wipe from bottom up to top.

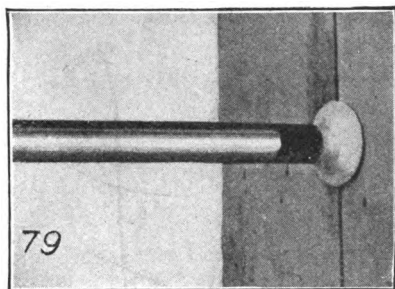


Wiping the far side from bottom to top.



Finishing wipe and throwing surplus solder off at top.

Fig. 76. This shows the wiping starting from the lower side farthest from the operator. When this has been wiped around till near the top of the joint, the cloth is changed to



The finished joint.

the other hand and the far side wiped again, the stroke commencing as near the bottom as possible and wiping upward, finishing at top as in Fig. 77.

On reaching the top a finishing cross wipe is made, the point being slightly past the center to make easier wiping and the motion being made from the pipe outward as in Fig. 78. On removing the excess solder and paper, the joint will appear as in Fig. 79.

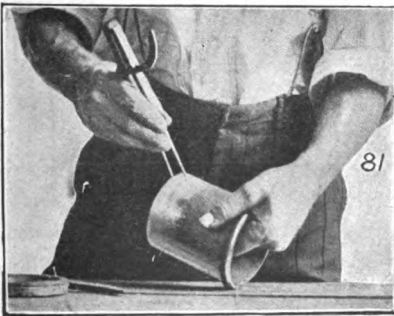
CHAPTER X

WIPING JOINTS ON LARGE PIPE

Thus far, only joints of small diameter have received attention, and as the wiping of a joint on 4-in. pipe or larger is something of a feat to most plumbers, this will be taken up next. This test of skill is included, and very properly, in almost every examination of candidates for licences, or in other tests of proficiency in the plumbing profession and is looked upon by most strivers after official approval as the test "par excellence." Once over it, they feel safe. But not only is skill in the manipulation of solder required to wipe successfully such a large joint; better preparation and more careful fitting is necessary than is the case with pipes of small diameter.



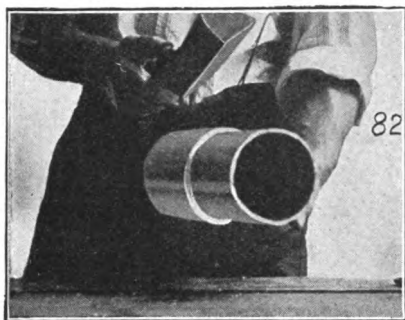
Filling ferrule for tinning.



Marking off length of tinning.

A competent judge will not fail to note the preparation as well as the wiping of a joint and uneven surfaces, bad fitting, which allows sharp needles of solder to project into the pipe and similar evidences of carelessness may be sufficient to hold up a certificate.

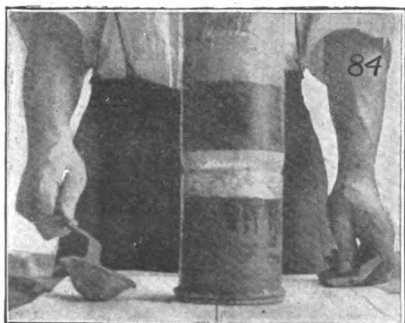
The softness of the metal renders transportation to and handling on a job of lead pipe of large diameter without



Beating in lead pipe to fit ferrule.



Lead pushed clear through ferrule and beating over end.

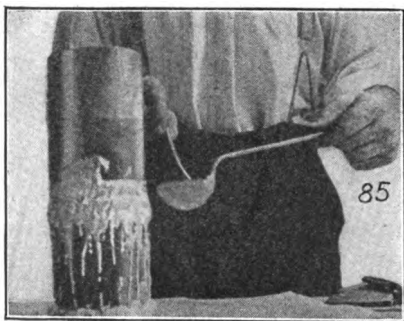


Joint ready to wipe.

damage something of a hard problem and minor dents and scratches are generally encountered. These are easily removed by passing "bobbins" through the pipe or by beating out depressions from the inside with a dummy—a round lead knob cast on the end of a cane or tube 3 ft. or so long, and by dressing the outside surface with the lead pipe held on a mandril or smooth iron pipe of slightly less external diameter than the internal diameter of the lead.

The preparation of the two ends when the correct shape and smoothness of the surface have been regained is of course similar to that for small pipes previously described. Where the joint is to be made to a brass ferrule the method is somewhat different and will be explained by reference to the views in Figs. 80 to 90.

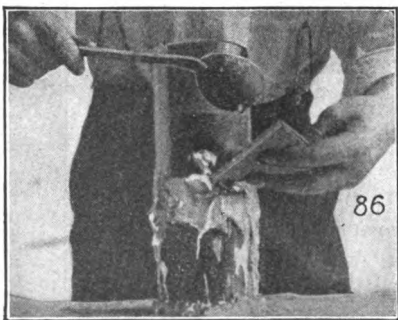
The first one shows the ferrule being filed for tinning. The importance of thorough filing has already been emphasized and a hint on making this easier is given in this view. It will be noted that the file is held at an angle to the ferrule, that the file is of the half-round pattern and that the part close to the edge of the half-round side is being used.



Throwing on solder with splash stick.

Holding the ferrule as shown and filing in this manner will give a bright and clean surface quicker and with less effort than is required to file with the flat side. In the second view, the length of the tinning is being marked after the surface has been dusted with powdered rosin.

If the brass shows any traces of oil or grease, chalk should be rubbed over it before soiling or paper should be pasted over it up to the tinning line. A moderately hot iron and rosin flux should be used and the edge of the ferrule as well as the outside should be thoroughly tinned.



Pouring on solder aided by cloth.

Instead of fitting the lead to the ferrule in the same manner as if both ends were lead, it is better to have the lead pipe go clear through the brass. This insures a perfect joint even if a sand hole should happen to be in the ferrule. It is necessary to reduce the diameter

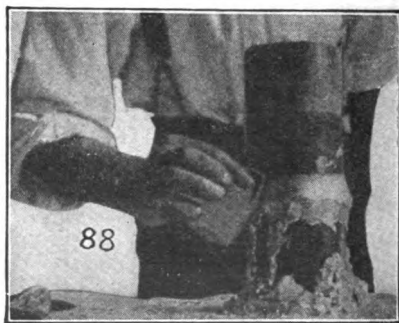
of the lead pipe somewhat to accomplish this and the operation of dressing it down is shown in Fig. 82. It should be kept in mind that too sudden a reduction in size is not



Wiping solder up on joint while getting up heat.

desirable and the lead should be so dressed that this is avoided. When the size has been brought down so that the ferrule fits snugly, the lead is beaten over the beaded end as shown in Fig. 83. The joint cleaned, soiled and set up for wiping is shown in Fig. 84.

There are various methods of pouring the solder on joints of this kind which require little or no steadying. Some men prefer to get up heat and pour on their solder with the pipe in a horizontal position and then set the joint up and wipe it vertically, while others follow the reverse practice and throw the metal on while the pipe stands vertically and then turn it down and "roll" the joint in wiping it. The general practice, however, is to set the joint up as shown and then proceed to throw the solder on either from the ladle or with the aid of a splash stick as shown in Figs. 85 and 86.



Beginning wiping by first wiping around top edge.

In either case as the heat rises the solder tends to slide down and must be kept up in position by continually bringing it up with the cloth or splash stick.

The operator is seen using his cloth for this purpose in Fig. 87. The top edge of the cleaning will always cool first and solder should be kept well up over it.

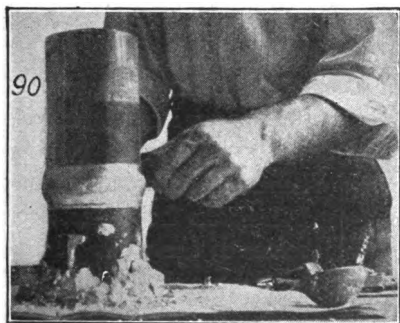
When enough heat has been raised and the solder is flowing all around, with body enough to insure a proper weight when finished, wiping should be commenced by drawing around the top edge as shown in Fig. 88. Get right in to the cleaning and use long smooth



Position of fingers in wiping.

strokes. Then pat the remaining solder into shape and, spreading the fingers and raising the middle one to get the right shape, as in Fig. 89, begin wiping as far around the joint as you can reach, and wipe quickly and with long strokes.

Be sure the cleaning on the brass side is reached,

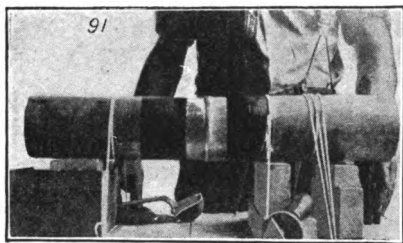


Making cross wipe at finish.

and if you are not able to wipe around to the starting point without changing hands, begin to wipe the reverse way with the left at a point slightly beyond the starting one so as to leave this smooth. Then make a cross wipe to finish or flick the excess solder off and let the

slight ridge sweat in if you have heat enough.

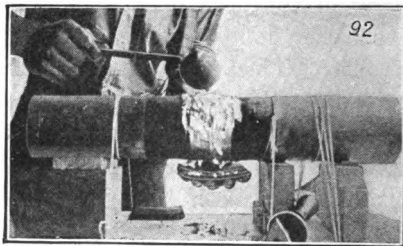
Immediately the wiping is finished pry the solder away from the ferrule at several points. This will make its



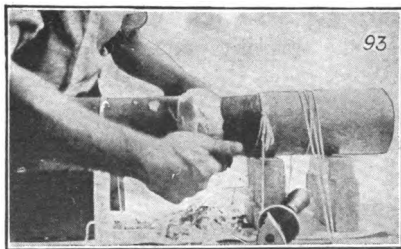
Four-inch joint set up and steadied with string.

is not necessary to state, of course, that it should never be held over a smoky flame.

If occasion should arise for the wiping of a joint of large proportions in a horizontal position, the mechanic who has previously only wiped these vertically or who has only wiped small joints before, will find considerable difficulty in making a presentable finish. The solder cools more rapidly and of course the length of the wiping is considerably more on a pipe of say 4-in. diameter than one of 2 in. or less. The cloths must of necessity be larger, at least the one used to catch the solder as it is poured on, otherwise the solder could not be poured quickly enough to get up heat in a reasonable time. When the heat has been secured, the wiping must be done quickly to avoid freezing on the edges and bottom.



Pouring on solder, using large blanket as catching cloth.

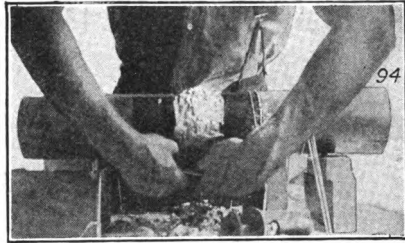


Forming joint, using catching and wiping cloth.

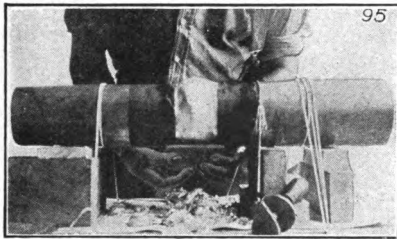
removal without marring the joint easy. A great aid in wiping such a joint is obtained by holding the parts over the flame of a fire-pot or torch for a few minutes before commencing to pour the solder on. It

Commencing as in the ordinary round joint wiping by pouring on

solder and allowing it to flow down the side farthest from the operator, bringing it up the near side as it falls into the cloth and keeping it in contact with the cleaning meanwhile to tin it as well as heat it, depositing the bulk on the top of the joint, an equal heat is thus secured. Then the ladle is dropped and the wiping cloth picked up in the right hand.

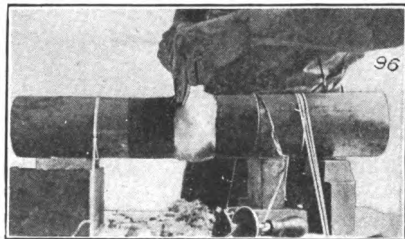


Beginning the wipe.



Wiping the near side, commencing where first wiping stroke began.

Commencing at the bottom as in Fig. 93, the solder is roughly molded into shape, using one hand on either side of the joint, and the edges roughly wiped. No time must be lost in this operation, but it is more important to get the edges down into shape than the body of the joint. The large cloth is dropped and the wiping cloth is taken in both hands and the wiper, reaching around from the top as far as possible, begins the wiping, pressing a finger on each side and allowing the cloth to form the shape that the joint will take. The motion is repeated from the bottom up the near side, and if smooth enough, the solder may be sharply thrown off as the highest point is reached or wiped to one side as is being done in Fig. 96.



Making cross wipe at finish.

If this joint is made to a ferrule, it may be rolled in the manner already described, and if properly done, a good shape and finish will be obtained.

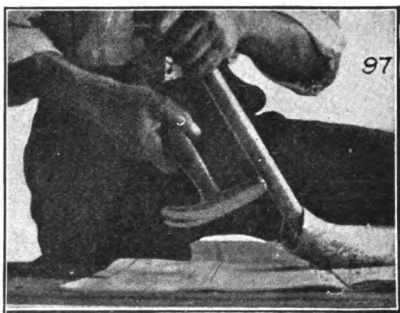
Careful fitting is necessary when two parts are being joined with a spigot and bell fitting, as the large diameter of the pipe lends itself to easy denting and flattening, and unless both ends are dressed into a true cylindrical shape it will be hard to prevent spikes of solder projecting into the bore.

The beginner will find most trouble in getting the bottom of his joint wiped as it cools there quickest, and if too much heat is applied the tin will drop out there. Therefore there must be no lost motion; cloths should be laid where they can be quickly picked up, the solder should be good and in sufficient quantity to insure a good heat being obtained before the wiping is attempted.

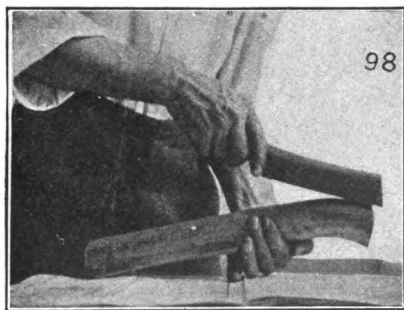
CHAPTER XI

WIPING Y-BRANCH AND OVERCAST JOINTS

IN ALL branch connections to lead soil and waste pipes a superior job is undoubtedly made by forming these so that the flow from the branch into the main will be toward the outlet. Where the connection is made by simply drilling a hole in the main pipe and wiping the branch in at an exact right angle to it, the flow has as much tendency to flow away from the outlet as toward it. This, of course, applies where the main pipe is in a horizontal position and the result of the tendency to flow each way is sediment deposited in the pipe at every backwash. Even where the branch enters a vertical pipe a



Beating up throat of bend.



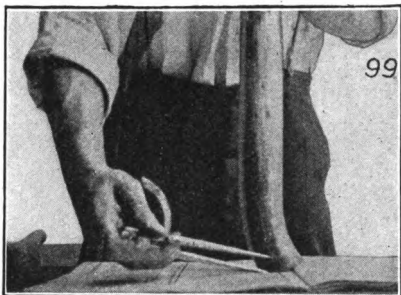
Dresser on heel of bend.

T connection is very much inferior to a Y or a T-Y, in that it is not so cleanly.

Deposits are often left at the edge of the pipe's change of direction from horizontal to vertical, and this may or may not be carried out by the next discharge from the fixture. Therefore the Y or semi-Y connection is one that ought to be made whenever possible on waste pipes. A different set of conditions applies in ventilating

work and T branches are, as a rule, perfectly satisfactory for that class of work.

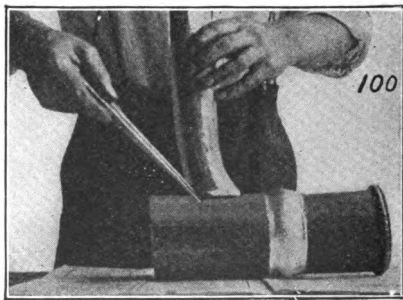
While the preparation and wiping of a Y branch requires a little more care and skill than an ordinary joint, there



Marking off correct angle at which to cut.

is nothing about it that cannot be accomplished by anyone who can wipe an ordinary joint if it is gone about intelligently. In preparing the parts for wiping, the branch part should be made ready first. If a full Y joint is to be wiped it will be necessary to saw the end so that the correct angle will be made, and then rasp it so that it will present a flat surface which will be in contact with the bench or a board at all points when tried out. The end is also to be rasped off to a tapered edge as is done with an ordinary branch and soiled and shaved about $1\frac{1}{4}$ in. up and in line with the angle at which the pipe is cut.

To prepare the other part a hole is first made by the tap borer and a knife or rasp used to form this hole into an oval-shaped one. Then with the bending pin the sides are raised until a correct fit with the branch part is obtained,



Marking size and shape of hole.

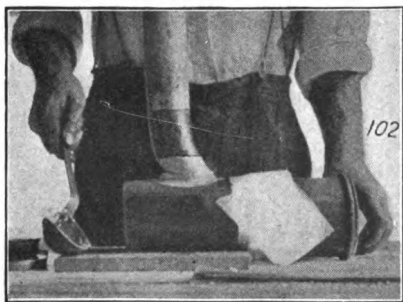
when the raised sides are rasped down until they are of equal height all around. This, with the careful rasping of the beveled end of the branch pipe, insures good fitting and freedom from trouble through solder getting inside

the pipe. Should it be preferable to use the modified Y branch as shown in the illustrations, the first operation in the preparation will be the bending of the end. This is very easily done by beating up one side with the aid of a bending pin about $\frac{3}{4}$ in. in diameter and dressing the heel of the bend with a smooth, flat dresser. This will quickly form a sharp bend on the pipe, and as it is not necessary to carry it beyond about 40 deg., very little thinning of the throat is evident. Should it be carried too far this, of course, would occur, but for the degree of bend necessary in this case the method described is preferable to bending with a spring, as no pipe whatever is wasted.



Setting up edges of hole to mark.

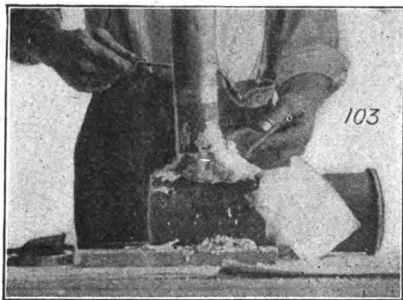
Fig. 97 shows the pin being used on the throat and Fig. 98 the dresser on the heel of the bend. Fig. 99 shows



Joint ready to wipe.

the pipe being held in a vertical position while it is being marked around so that it will fit evenly in the hole in the main pipe. After the pipe is sawed off to the mark, the end is rasped and tapered as before described. In Fig. 100, the operator is seen marking around the branch pipe to obtain a guide to the size of the hole he will have to drill and a mark to which he will turn up the edges with the bending pin as he is seen doing in Fig. 101. It will be noted in Fig. 102, showing the

joint set up, that the cleaning on the main pipe is shorter on the side next the outlet and longer than usual on the other side. This is because the bend throws the pipe off from the center of the hole, and unless the cleaning were made in this fashion the joint would be both unsightly and hard to wipe.



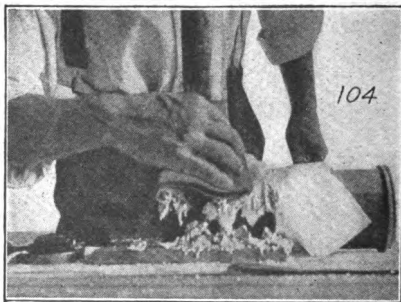
Pouring on.

As will be seen in the next three illustrations, the method of wiping the joint is identical with that used on a small T joint, speed and an eye for good shape being all

that is necessary to secure a neat and attractive joint.

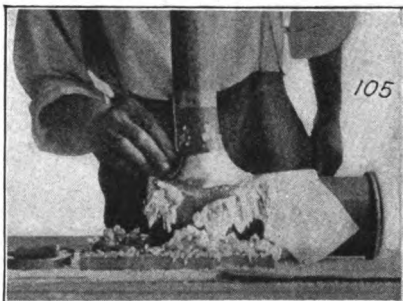
Note the pasting of wrapping paper on the pipe to protect the ferrule joint while being wiped. It happens very often that two joints come close together and this offers the readiest way to prevent solder adhering to the joint. The paper, however, should be pasted so that it will not interfere with the quick raising of heat on the branch joint, as the solder does not conduct heat very readily through it.

Fig. 107 shows the appearance of the finished joint. A full Y joint will appear, of course, somewhat longer than this, and as it is hard to wipe in at the acute angle with a short cleaning, that on the branch pipe may be kept a little longer than it would be made on a T joint with advantage.



First position in wiping.

Joints of various other types are, of course, occasionally wiped, for instance the cross branch, but these are more used for ornamental purposes than for actual utility. Therefore it may be said that they are only performed by experts in this line of work and cannot come within the scope of this book. Those which have been treated of in the foregoing chapters cover all that are met with in daily practice. If all of these can be made in a workmanlike manner and the balance of the work



Second position coming around the end.

executed in a way that will compare well with the quality of the joint wiping, the mechanic need not have any hesitation in attempting cross joints or other forms if he feels that he would like to use them, as he will readily see where the difficulties of the type he is trying to make lie and will

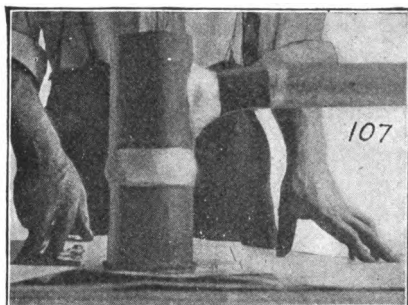


Using left hand to wipe throat and front of joint.

be able to surmount them with a little practice. But there are one or two other styles of joining pipes which he should also be acquainted with, although he may not care to use them, as they are not commonly practised. One of these is known as the "Overcast Joint."

The practice of overcasting wiped joints may be said to have fallen into disuse. The reason for ever doing it at all is not very apparent, but probably when it was first begun joint wiping was not such a general accomplishment

as latter-day plumbing has made necessary. The plumbers of the bygone age of seamed pipe, hand-made bends and traps were experts with the copper soldering bit, and probably had more confidence in a joint made by that means



The finished joint.

than they had by the wiping method. Then, when they installed a pump with a lead suction pipe they first wiped the joints and then, taking a good hot iron, or occasionally one might use a tank iron, they melted the surface of the joint in longitudinal motions

from cleaning to cleaning, thus getting the effect shown in Fig. 108 of the accompanying illustration. They claimed that this eliminated all leakages, and doubtless it did, but if the joint had been properly wiped, with solder of the right proportions, there would be no leaks from that cause, as we are now well aware. The process was also recommended for joints on pipe where pressure was heavy.

The term is also used for joints made with a copper bit which present a similar appearance to that on the sketch. As a rule, however, the cleaning is shorter for a joint made with the copper. In making this, the lead pipe is cupped out and cleaned as if for a wiped joint, but only for about



Fig. 108.



Fig. 109.

Overcast joints.

$\frac{1}{2}$ in. on each end unless large pipe is being used, when it may be a trifle longer. Solder is then built on all around at a fair heat to insure good tinning. After enough has been roughly built up to insure a finished shape

resembling that in Fig. 109 the pipe is held in a horizontal position and a good hot iron, well tinned, is used to finish it. This is done by the point of the iron. It should be touched to the solder at the cleaning end, moved across the surface to the other cleaning, then smartly lifted. Allow a second or two to cool the solder, then slightly turn the pipe and repeat the operation. This is done until a complete turn of the pipe has been made, when a little grease should be applied to the joint, and the rosin will then be easily removed with a cloth.

A man who knows how to handle an iron can float a joint of this description so that no ribbed appearance is made at all. The joints on the old 4-in. seamed pipe were made in this fashion where two parts could be put together on the bench, and a hatchet iron was preferred by most plumbers for this work.

There is another method of treating a wiped joint which is not generally known and which requires considerable skill and practice to get good results. This is a method known as "cold wiping." After a round joint has been wiped in the regular way, it is allowed to cool off until the metal is thoroughly set. Then the ladle is filled up to about three-quarters of its depth with hot solder and one or two chunks of cold solder added until its temperature is low enough to suit the operator. It is hard to say just how hot it should be,—this can be best learned by experience,—but it should be "too cold for wiping but hot enough to keep melted." This solder is taken as if the joint were to be rewiped. The cloth is held in the left hand as usual and quickly thrown over the joint. The surplus falling into the cloth is at once brought over the top. The ladle is then dropped, and one wipe made to finish. This is where the skill is required, since, if more than one motion is made, the skin of molten metal will freeze along the edges. If the wipe is successful a beautifully bright and smooth joint will be the result. A joint made in this fashion will withstand any pressure the pipe

is capable of resisting without showing any signs of porosity, and sometimes when a trying lot of solder is encountered and the usual doctoring is not successful, this cold wiping accomplishment will be found extremely helpful.

When a joint has to be wiped close to the end of the pipe as shown in Figs. 110 and 111, it is often sawed off at an angle, and after the bore has been seamed out, a wad of paper is inserted and the end wiped up. This method has

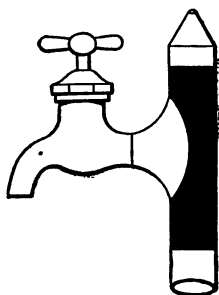


Fig. 110.

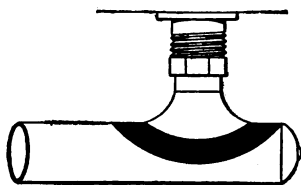


Fig. 111.

Ends of pipe beaten in close and soldered.

disadvantages, one of which is that the wad of paper may become dislodged and find its way into some part of the pipe where it will form an obstruction. The methods shown in Figs. 110 and 111 are preferable for that reason and just as neat in appearance. These consist in dressing the end of the pipe until the sides are caused to meet, when a small point of solder is applied with the aid of a small copper. This can be filed off smooth if desired so that it will be invisible.

CHAPTER XII

WIPING JOINTS ON VARIOUS KINDS OF PIPE

WIPE joints are often required on copper pipe in certain classes of work, for instance, in distillery work, and as the preparation of these is entirely different from those upon lead pipe, some description is necessary. Proper proportions of the metals used in making the solder, purity and closeness of texture, firm patting up in building the joint and sufficient length and weight of joint are absolutely necessary on copper pipe work, regardless of what the pipe is to be used for. The length of joint is generally made longer than it would be on lead pipe, and on pipes of 2-in. to 3½-in. diameter the length varies from 2½ to 3½ in., and as the diameter increases the length is increased, although of course not proportionately. Whether this is the result of custom or is necessary to withstand the greater movement in expansion is not a matter of moment; possibly if due allowances were made for expansion and hangers were provided to take the weight off the pipe, joints much shorter would last equally well.

What is far more important is the matter of tinning the copper when preparing the ends for joining together. Corrosive action will begin at once to eat the tinning from the copper, and if this has merely been carried to the end of the pipe it will very quickly proceed far enough so that the joint will be seriously weakened, and ultimately will leak. The ends should be cleaned both outside and inside and thoroughly tinned as in Fig. 112 along a distance of 5 or 6 in. at least by dipping in a pot of molten solder, after being dusted with rosin or painted with a mixture of rosin and lard oil. The value of this thorough tinning has been repeatedly demonstrated, and it has been shown that even a spot left untinned near the end may be enough to allow of

corrosion beginning and spreading little by little until the joint is finally leaky.

After the ends are tinned, they are brought together and one end slipped inside the other. If necessary the small end may be reduced by heating and hammering, or the large end



Fig. 112.

Copper pipe tinned inside and outside before wiping.

may be expanded by the same means, this of course being done before tinning. When a lap is made in this fashion, the sweating of solder into the junction not only strengthens the joint but retards corrosion and lengthens the life of the job.



Fig. 113.

Copper pipe placed over pot to pour hot solder over it.

Since copper cannot be burned, as much heat as is wanted may be applied in getting up a working heat to wipe the joint. Paper should be pasted around the pipe at the correct length of cleaning required and then the solder pot may be placed directly under the pipe as in Fig. 113 and

metal poured on it for some distance along each side, allowing it to run back into the pot.

When wiping, if the pipe is of large diameter, use a large catch cloth and have a board or shovel to catch the solder which drops from it. Pick this up if it is plastic, occasionally, and dump it on top of the body of solder that is being built up on the joint and then pour on hot solder from the ladle. When the solder has reached a heat that will insure a smooth finish, wipe as would be done for a lead pipe and cool off by spraying with water, looking out for the bottom particularly, so that it will not drop owing to the heat-retaining power of the copper with consequent slow setting of the solder. The finished joint is shown in Fig. 114.

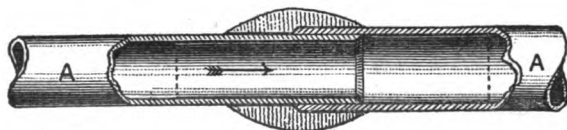


Fig. 114.

Section of joint on copper pipe showing pipes slipped together.

Wiping joints on iron pipe is not often done, nor can it be recommended, but should it be necessary, the procedure is identical with that just described. Even more care is required in tinning, as the metal is much more liable to corrosion and is also harder to get clean enough to tin well. Chloride of zinc, commonly known as "cut acid," is the best flux to use for tinning, but it should be well washed off before wiping the joint.

Wiping joints on tin-lined pipe is a hard proposition. Probably the best means of preventing the tin lining from melting and forming beads on the inner surface is to make a ferrule of thin tin plate and insert it at the junction of the two pipes and also to use paper and paste on the outside instead of soil. Then the joint should be wiped with the lowest temperature possible.

Adding bismuth to solder lowers the melting point considerably. Bismuth solder, so called, consists of 2 parts lead, 2 parts tin and 1 part bismuth and melts at 290 deg. F. This may be used to wipe joints on block tin pipes for bottling factories and similar purposes, but this is a difficult operation also, although the block tin itself does not melt below 440 deg. F.

Good results may be obtained by making overcast joints with the soldering iron on block tin pipe and using a very

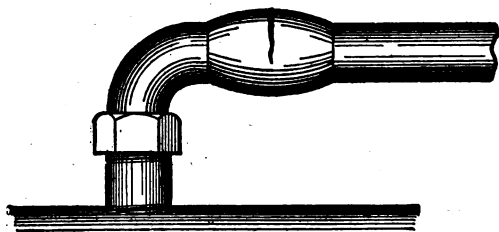


Fig. 115.

Joint broken as the result of expansion.

fine solder. A composition of lead and tin in the proportion of $1\frac{1}{2}$ of tin to 1 of lead melts at about 350 deg. F., and this is low enough to admit of its being used either with an iron or a blowpipe on this class of pipe.

Pipes that are used for the conveyance of ammonia, if they are to be soldered, should be soldered with pure block tin. Either a blowpipe or a soldering iron may be used and the tin flows easily on iron or any of the metals in use for this kind of work.

Before completing this chapter it may be well to emphasize the necessity of supporting all pipes of a nature that tend to sag when heated. Tin or lead pipes in particular require careful fitting and supporting, and this will often prevent breakages at joints from this cause. Another cause of breakages is the absence of provision for expansion

and contraction. This is unequal with different metals and is the most common cause of breakages and leakages on joints on lead water pipes. These are most commonly met with on the lead pipes of a range boiler connection, the reason being that the expansion is often excessive there and no support is given to the pipe. Since it lengthens with expansion, it accordingly sags and each successive lengthening and sagging weakens the walls of the pipe until it finally gives way as shown in Fig. 115, or at the end of the joint where a deep shaving may have weakened it.

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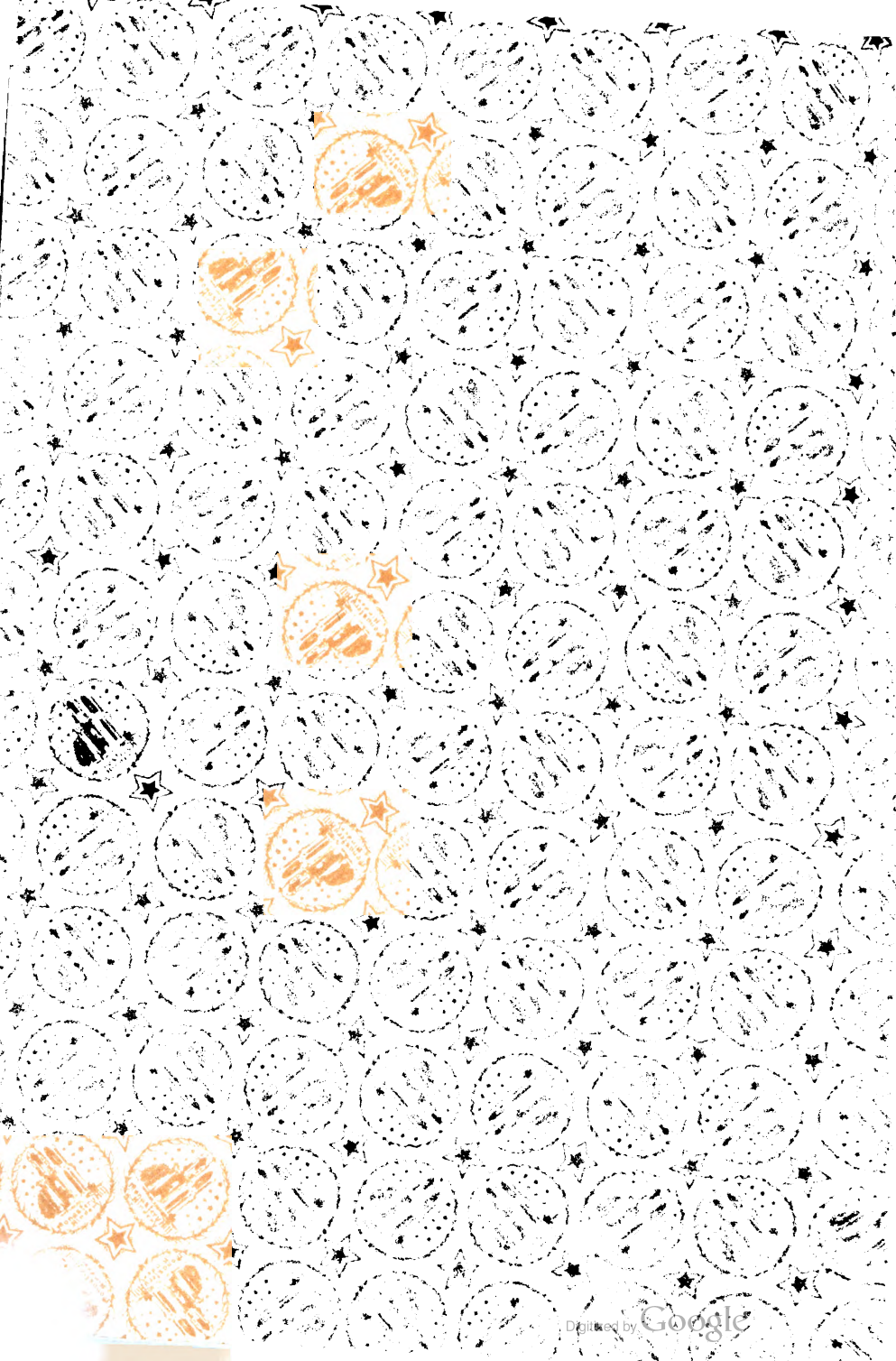
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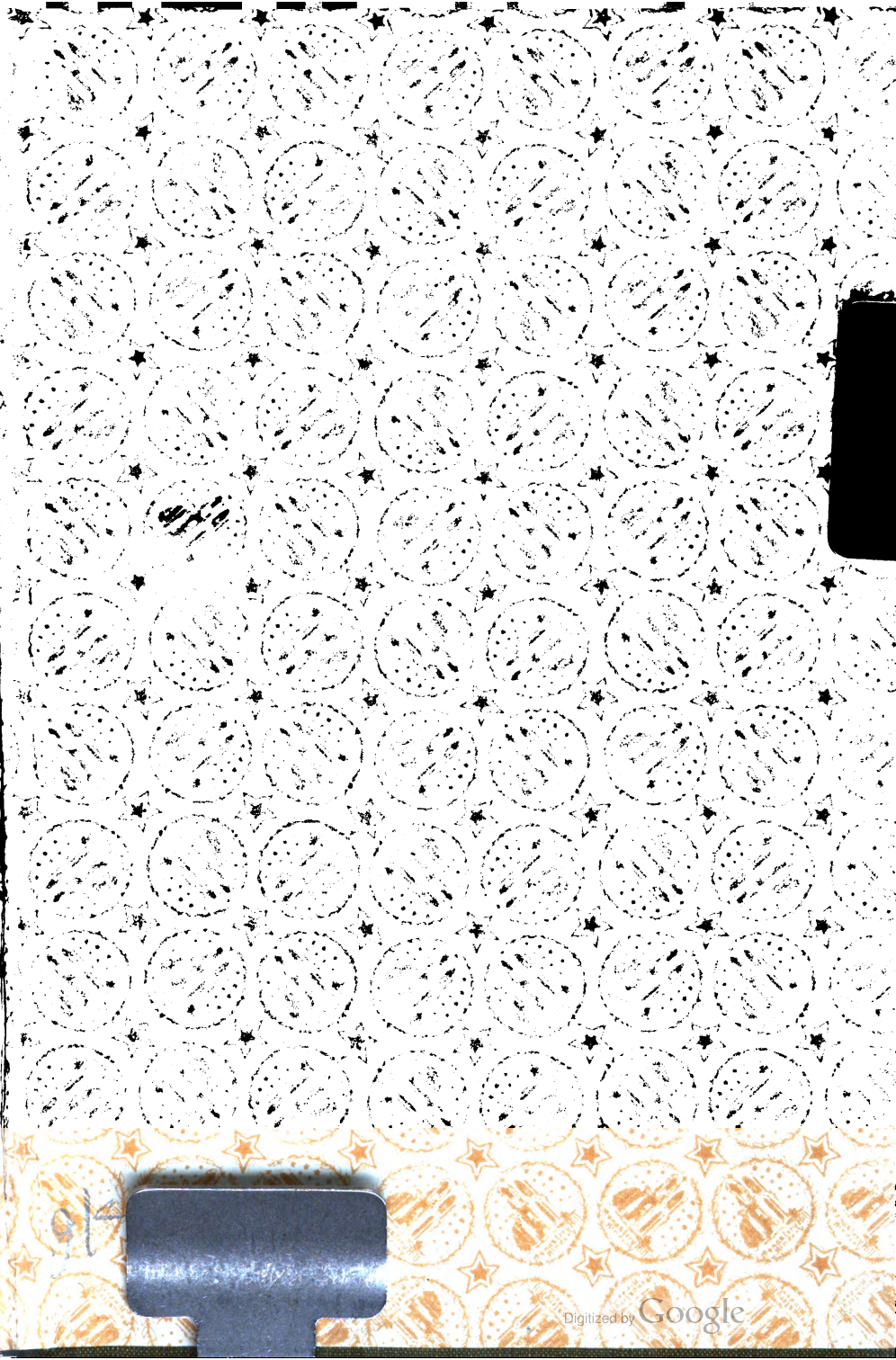
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